

NASA GRANT NAG-1-1755 (033734) FINAL REPORT

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***Richard P. Schuster (Paul), REU, Summer 1995

***Inder Singh, REU, Summer 1996

***Anish Goel, REU, Summer 1996

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•supported by this grant

**supported by NSF REU Site Grant to UM Chemistry Department

*** supported by NSF REU Site Grant to UM AOSS Department

SUMMARY

Fabrication of the University of Michigan Multichannel Chemiluminescence Instrument (UMMCI) was completed in early 1996 and the instrument participated in test flights on the NASA P3B at Wallops Island prior to integration and deployment for the PEM-Tropics A Mission. The UMMCI consists of 4 channels for simultaneous measurements of ozone and NO with the option for measurements of NO₂ and NO_y (total reactive nitrogen) when converters are placed upstream of the NO channels. Each NO channel consists of a zeroing volume and reaction vessel, while the ozone channel consists of an ozone catalyst (or scrubber) trap that is not in line with the reaction vessel. The detectors in all for channels are Hamamatsu photomultiplier tubes, which are followed by pulse amplifier discriminators on the NO channels and an electrometer on the ozone channel. Schematics of the Detector Module and NO_x/O₃ Probe Insert and Diagrams of the Control and Data System, the Power and Ground System, the Gas Flow System, and the Calibration System Flow are attached.

Intercomparisons were conducted with G. Gregory, NASA/Langley, during the test flights (following prior calibration of the ozone generator/calibrators at the Wallops Long-Path Absorption facility). Initial test results appeared to be reasonable, and instrument characterization studies proceeded for the ozone channel and the 3 NO channels until deployment for integration for the PEM-Tropics Mission.

Ozone data was obtained for Flights #4, and 6-21, and finalized data was submitted to the PEM-Tropics Data Archive and to the Science Team during the April 1997 Data

Clarke, A. D., D. Davis, V. N. Kapustin, F. Eisele, G. Chen, I. Paluch, D. Lenchow, A. R. Bandy, D. Thornton, K. Moore, L. Mauldin, R. Tanner, M. Litchy, M. A. Carroll, J. Collins, and G. Albercook, Particle Nucleation in the Tropical Boundary Layer: A Case Study Involving Marine Sulfur Sources, *Science*, 282, 89 - 92, 1998.

Clarke, A. D., F. Eisele, V. N. Kapustin, K. Moore, R. Tanner, L. Mauldin, M. Litchy, B. Lienert, M. A. Carroll, and G. Albercook, Nucleation in the equatorial free troposphere: Favorable environments during PEM-Tropics, *J. Geophys. Res.* 104 (D5), 5735-5744, 1999.

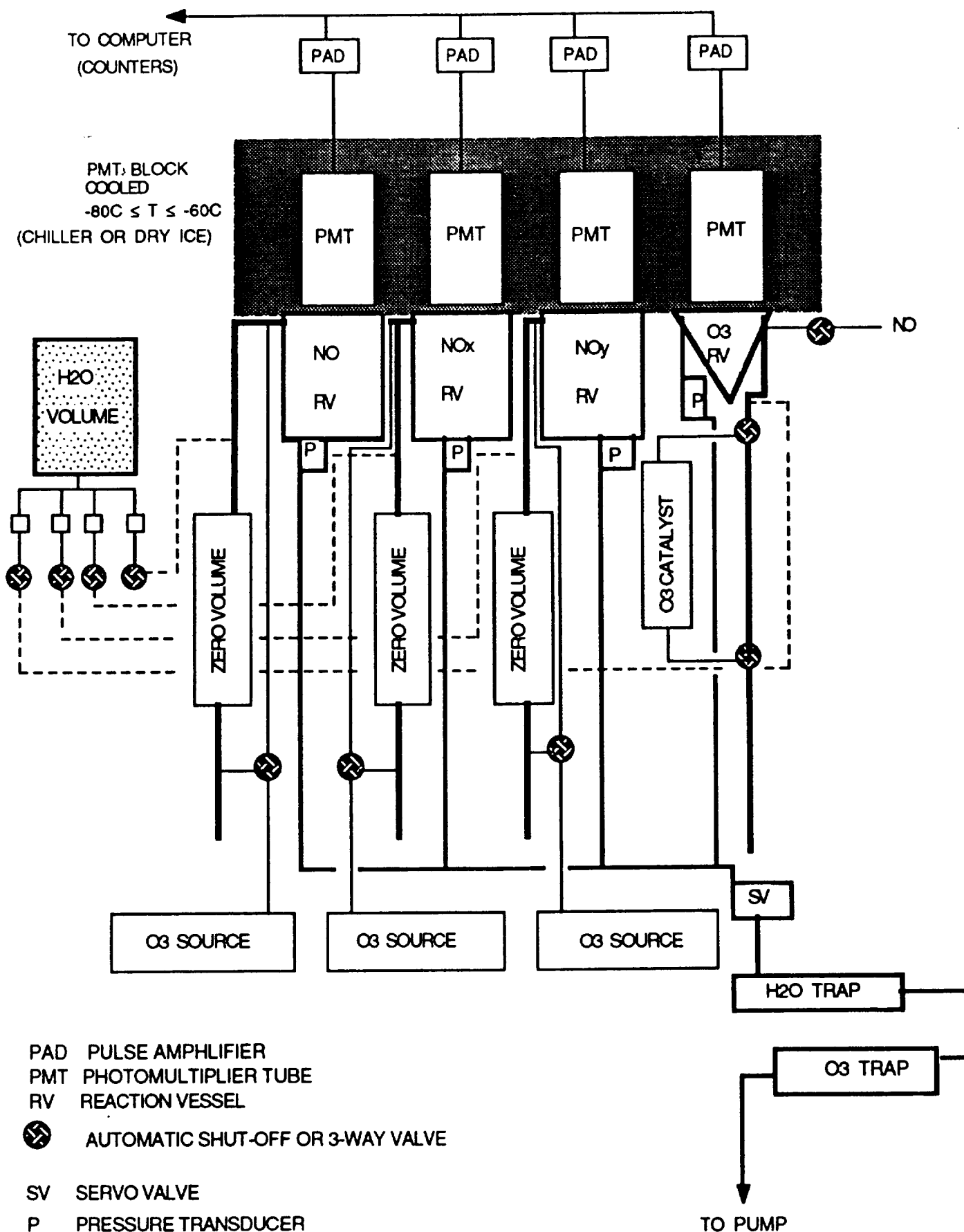
Emmons, L. E., D. A. Hauglustaine, J-F. Müller, M. A. Carroll, G. P. Brasseur, D. Brunner, J. Staehelin, V. Thouret, and A. Marengo, Data composites of airborne observations of tropospheric ozone and its precursors, *J. Geophys. Res.*, in press, 2000.

Stoller, P., J. Y. N. Cho, R. E. Newell, V. Thouret, Y. Zhu, M. A. Carroll, G. M. Albercook, B. E. Anderson, J. D. W. Barrick, E. V. Browell, G. L. Gregory, G. W. Sachse, S. Vay, J. D. Bradshaw, and S. Sandholm, Measurements of atmospheric layers from the NASA DC-8 and P-3B aircraft during PEM-Tropics A, *J. Geophys. Res.* 104 (D5), 5745-5764, 1999.

MANUSCRIPTS SUBMITTED

Chen, G., D. Davis, J. Crawford, B. Heikes, D. O'Sullivan, F. Eisele, L. Mauldin, D. Tanner, J. Collins, J. Barrick, B. Anderson, J. Bradshaw, S. Sandholm, M. Carroll, G. Albercook, A. Clarke, An assessment of HO_x chemistry in the tropical Pacific boundary layer: Comparison of observations with model simulations during PEM Tropics A, submitted to *J. Geophys. Res.* 1999.

DETECTOR MODULE

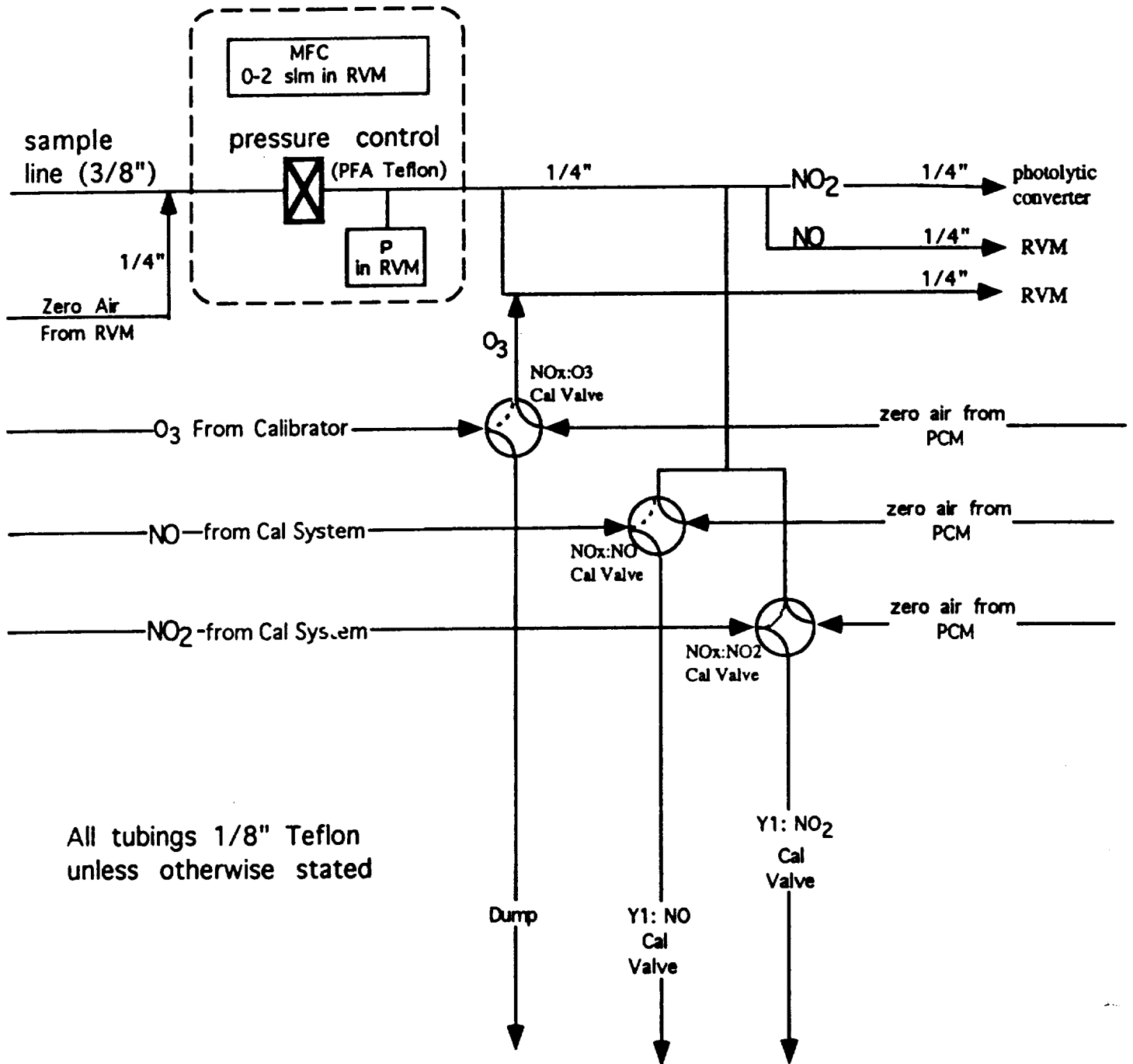


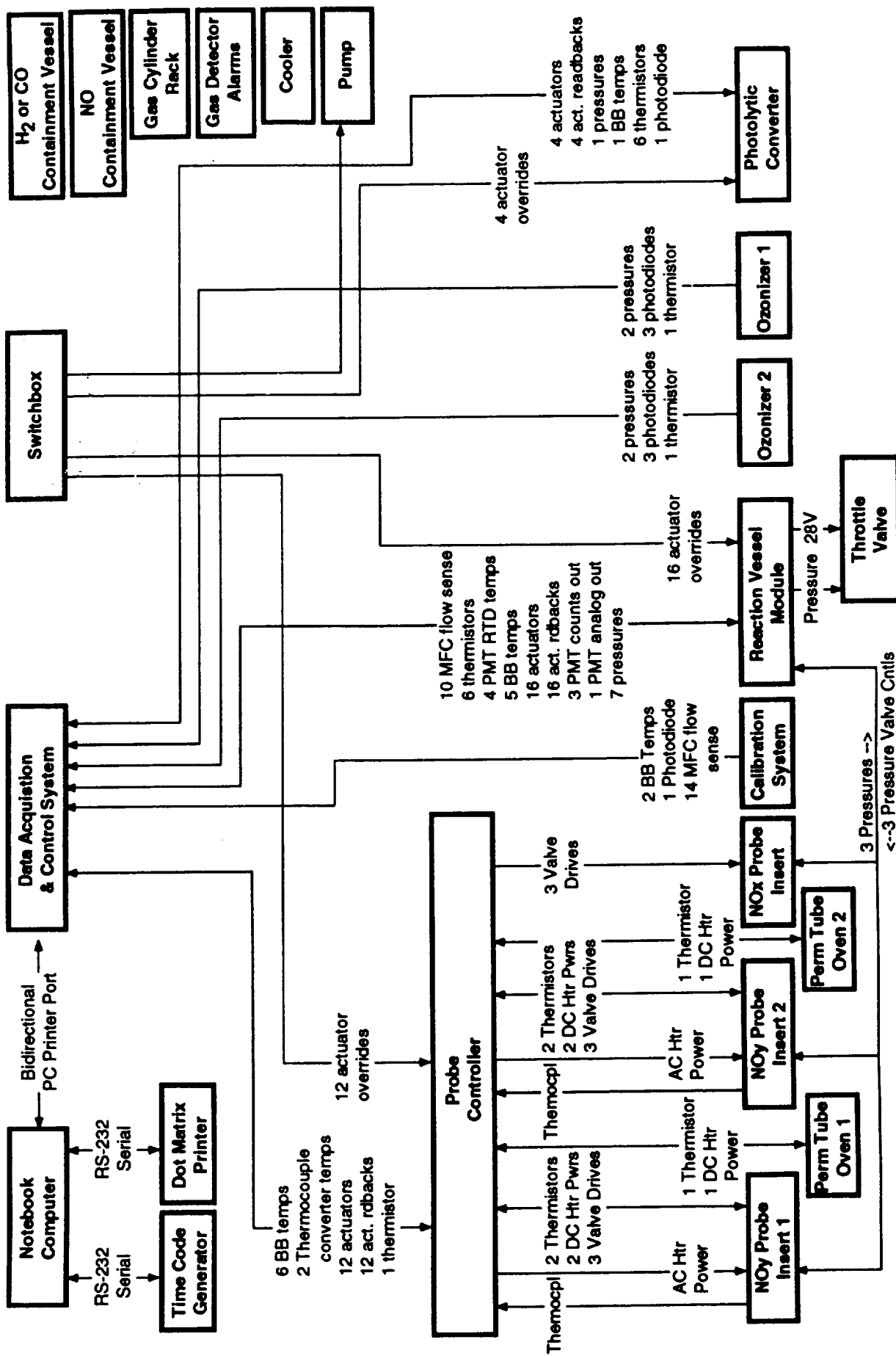
3298A: NO_x/O₃ Probe Insert

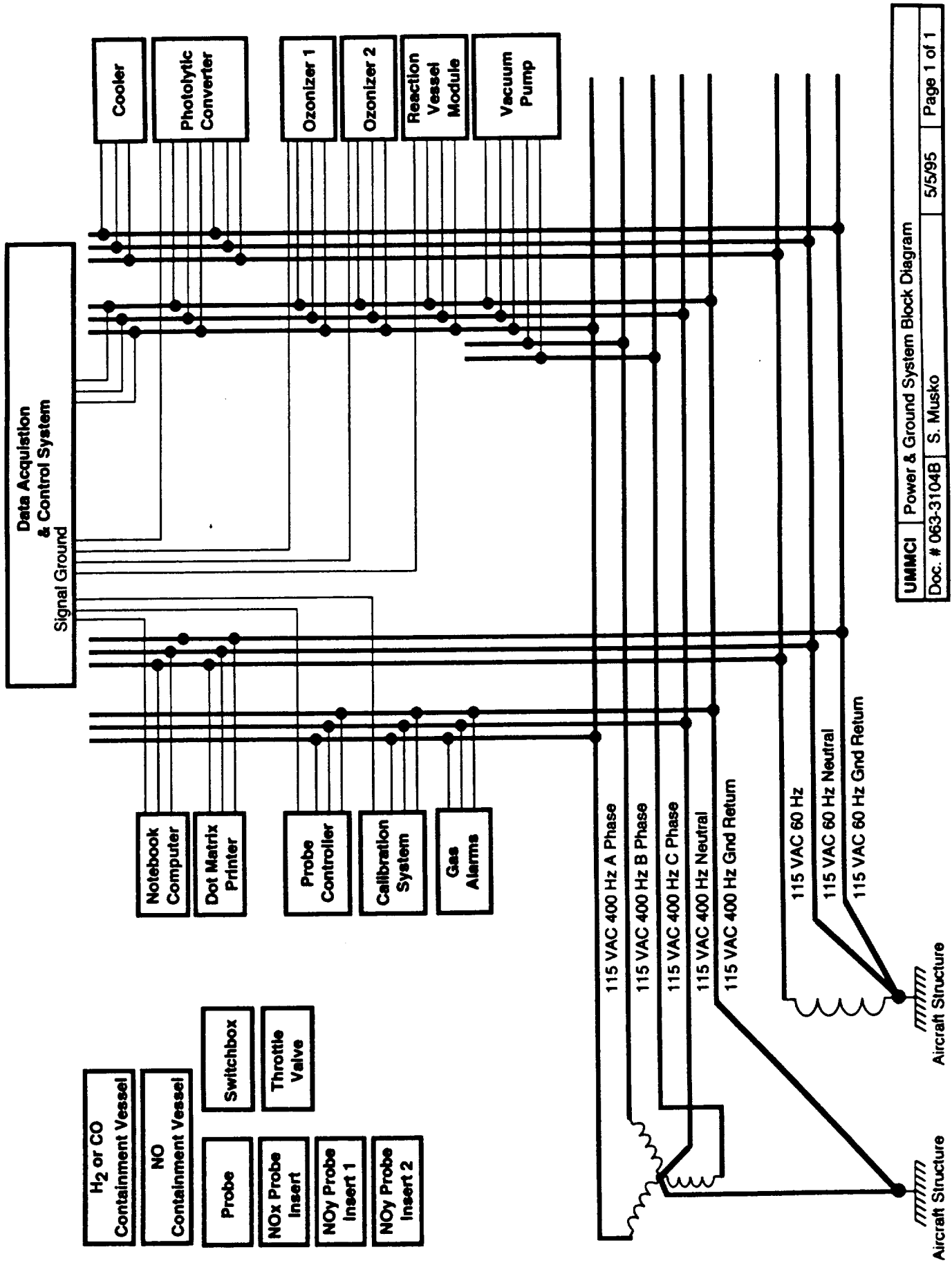
6/20/95

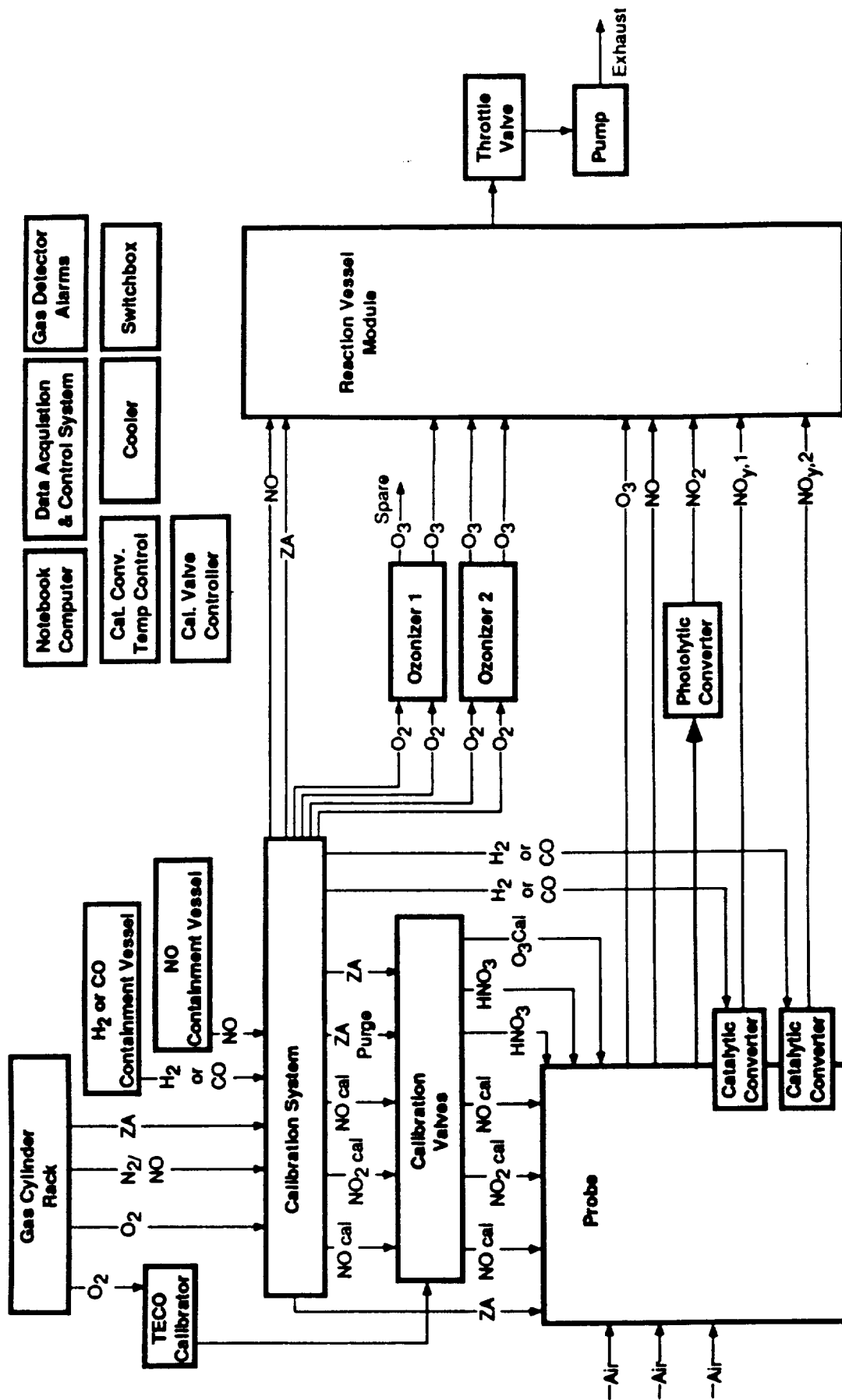
L. Feng

In NO_x Probe Insert folder

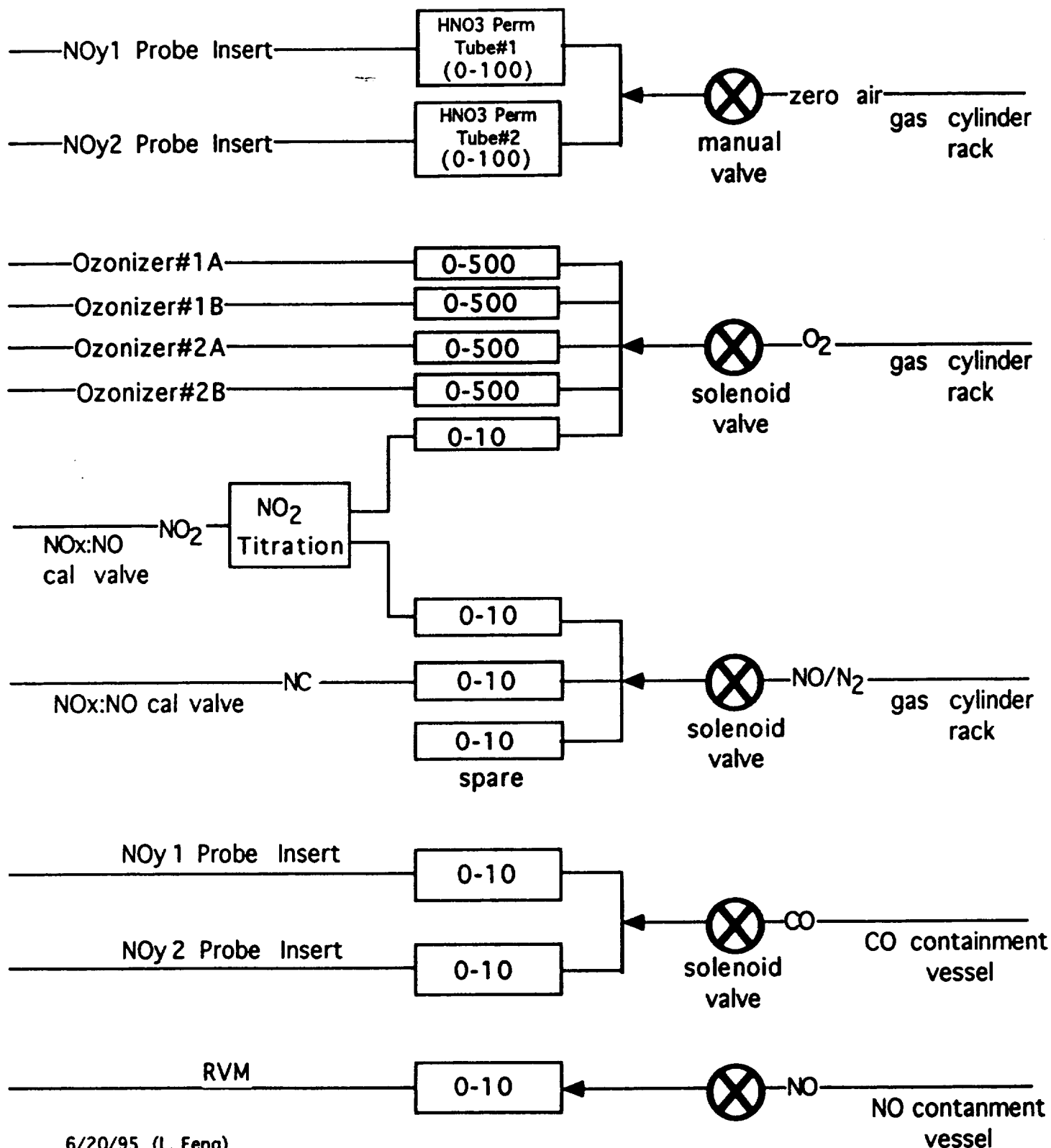




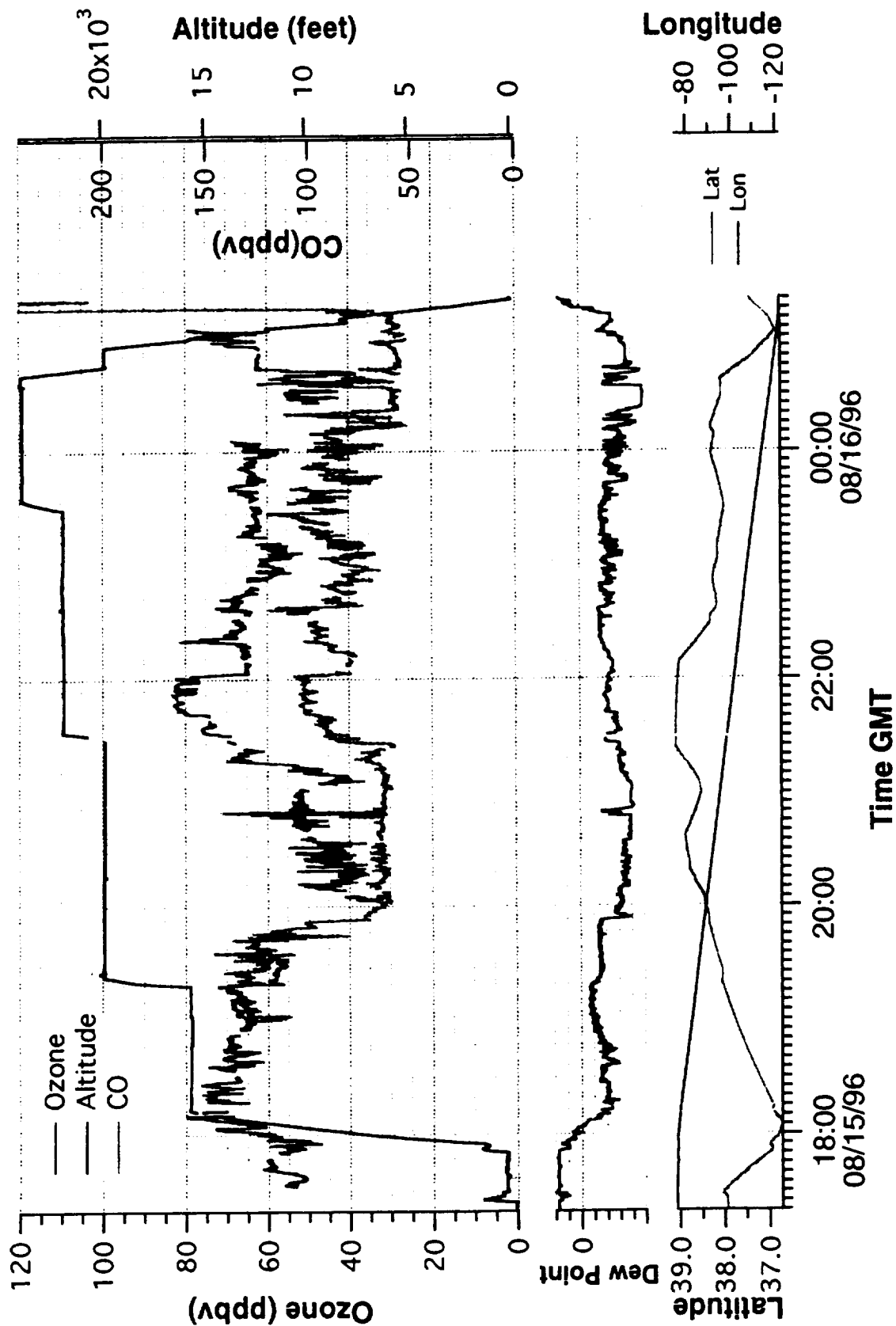




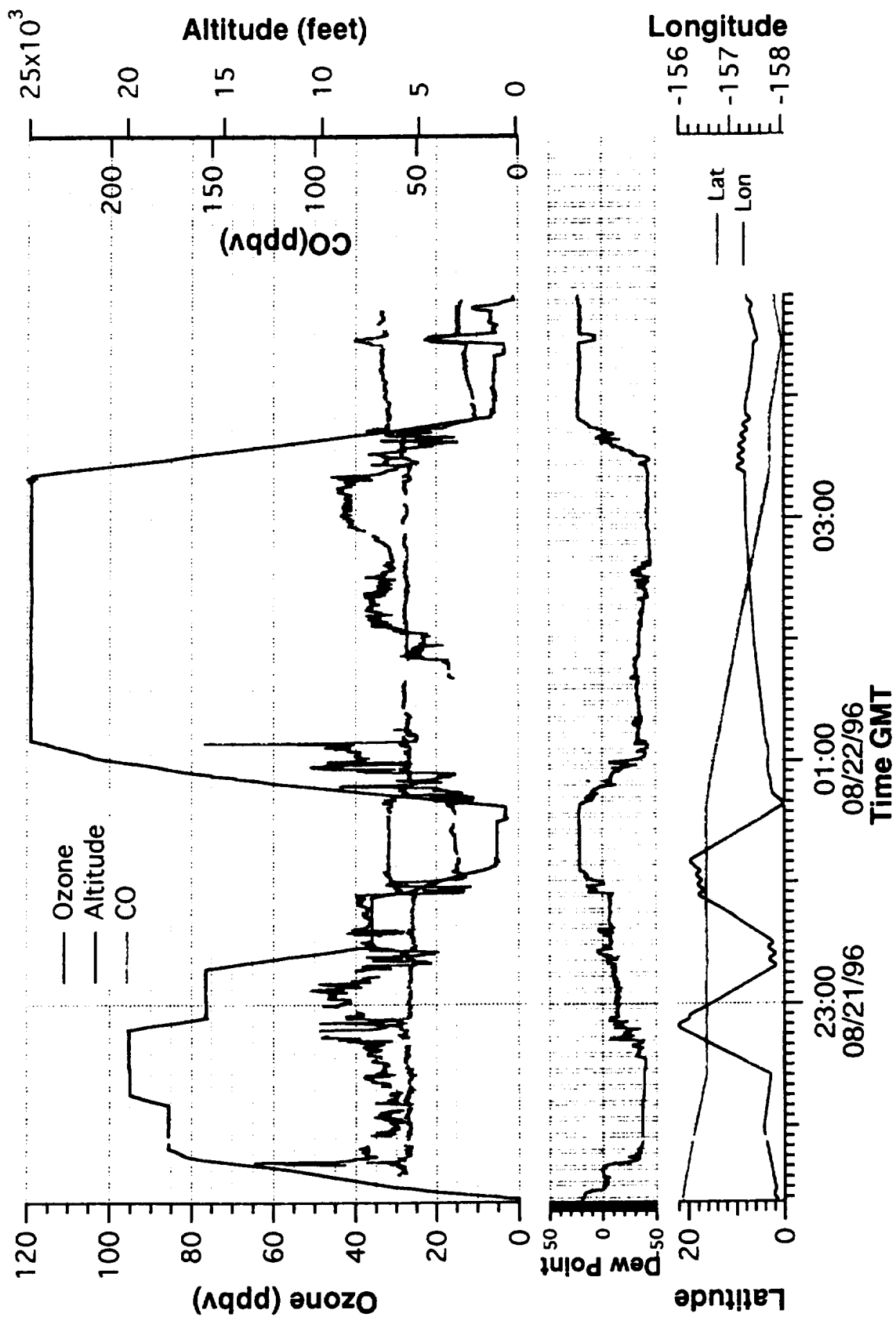
3333 Calibration System Flow Diagram



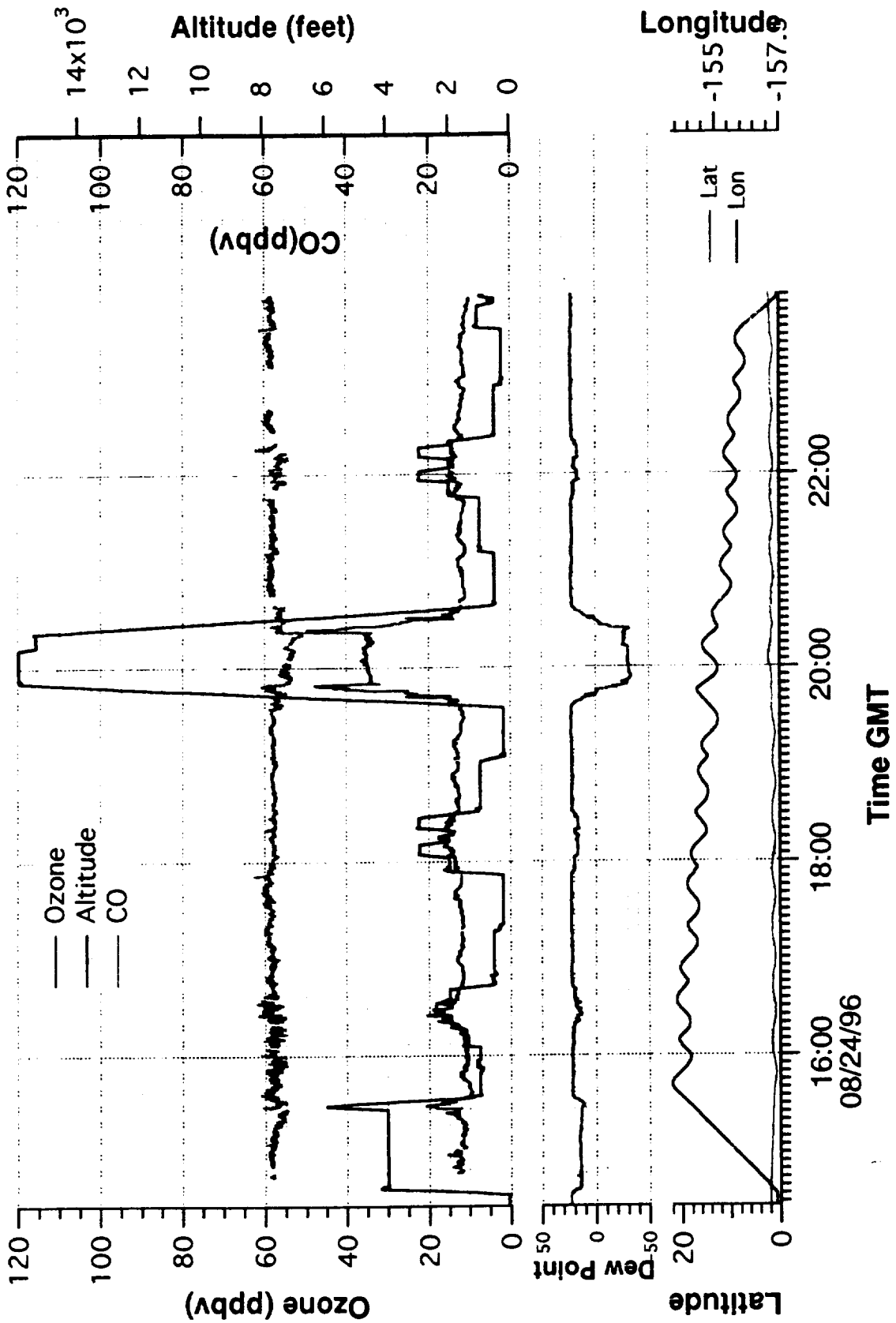
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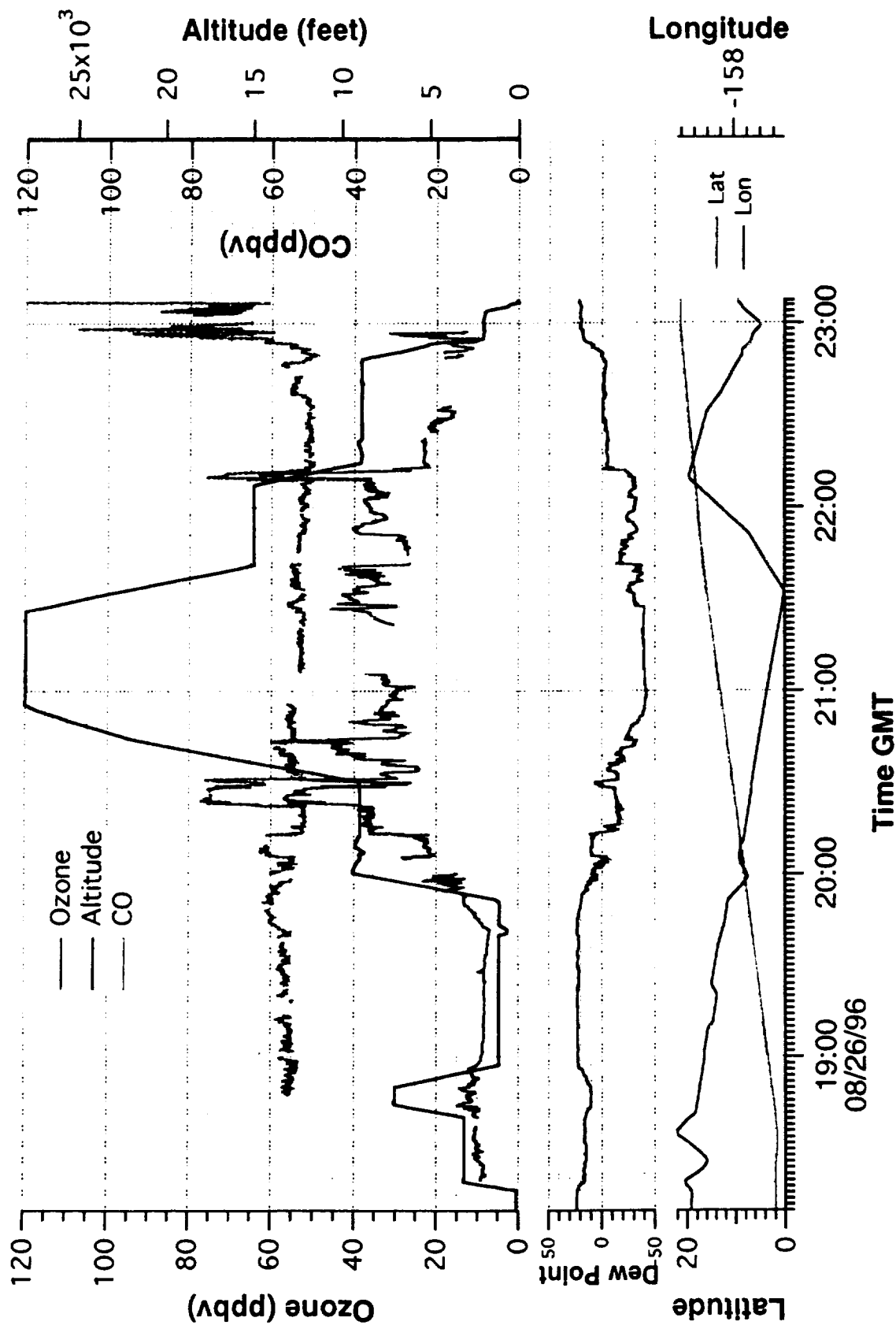
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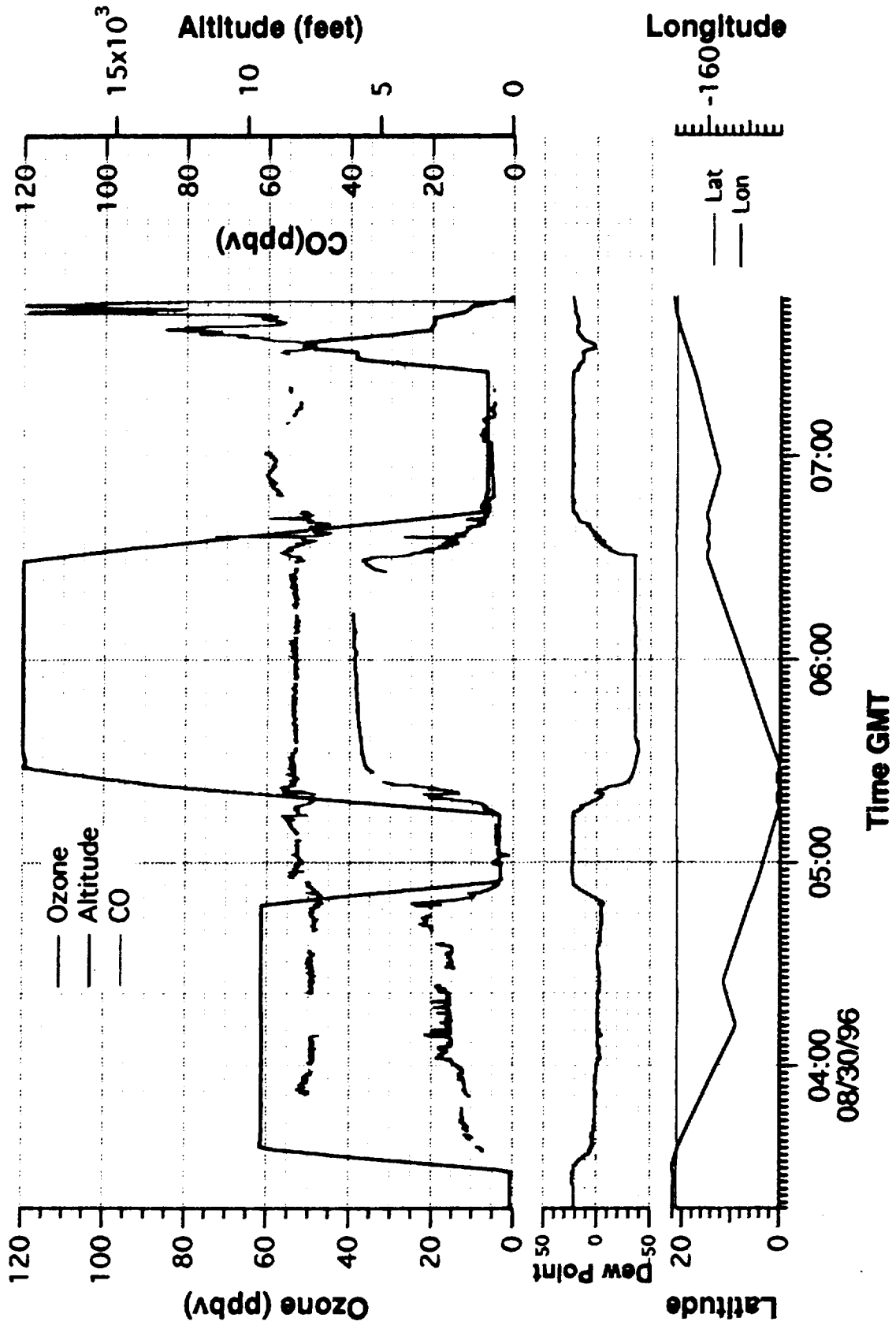
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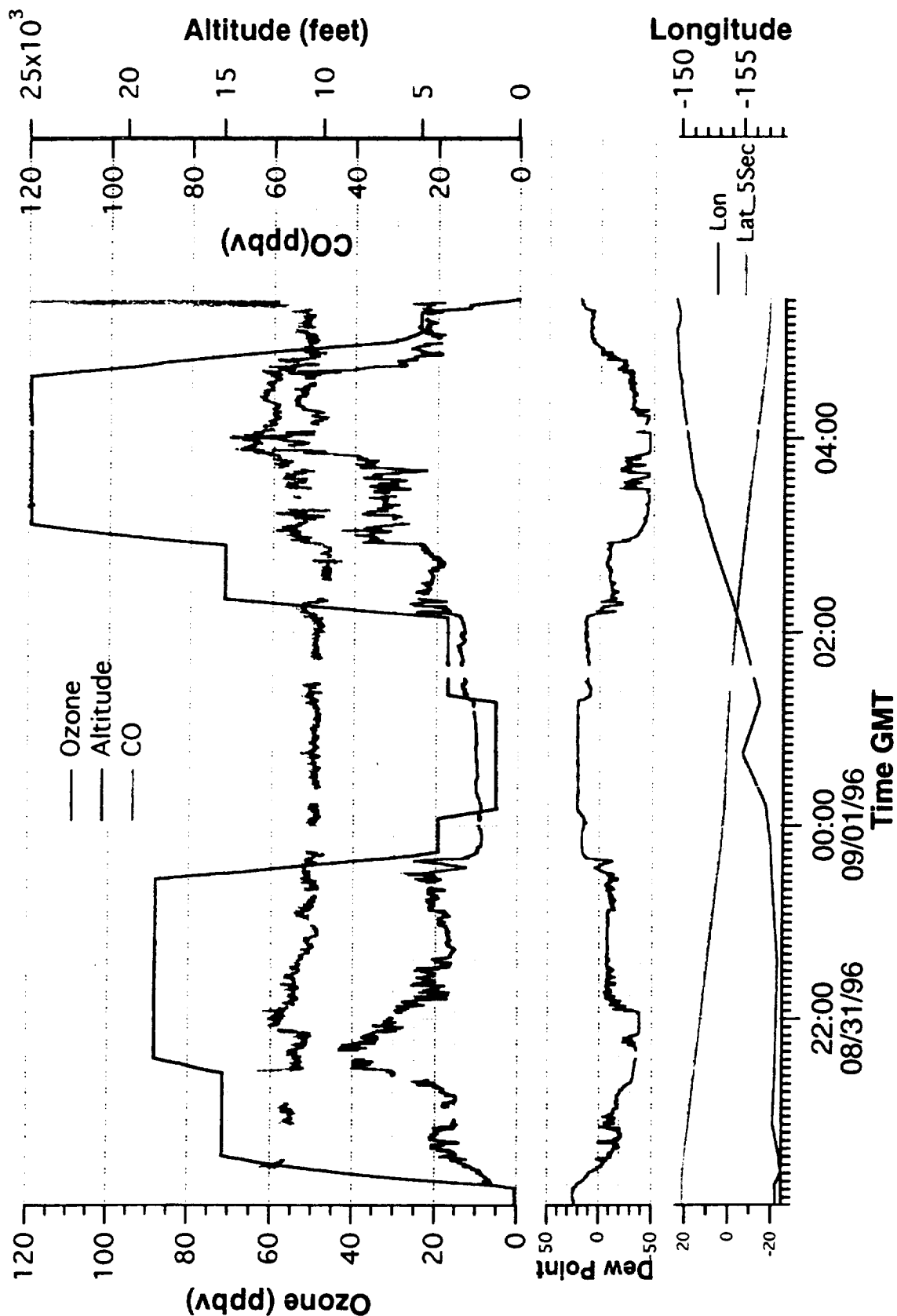
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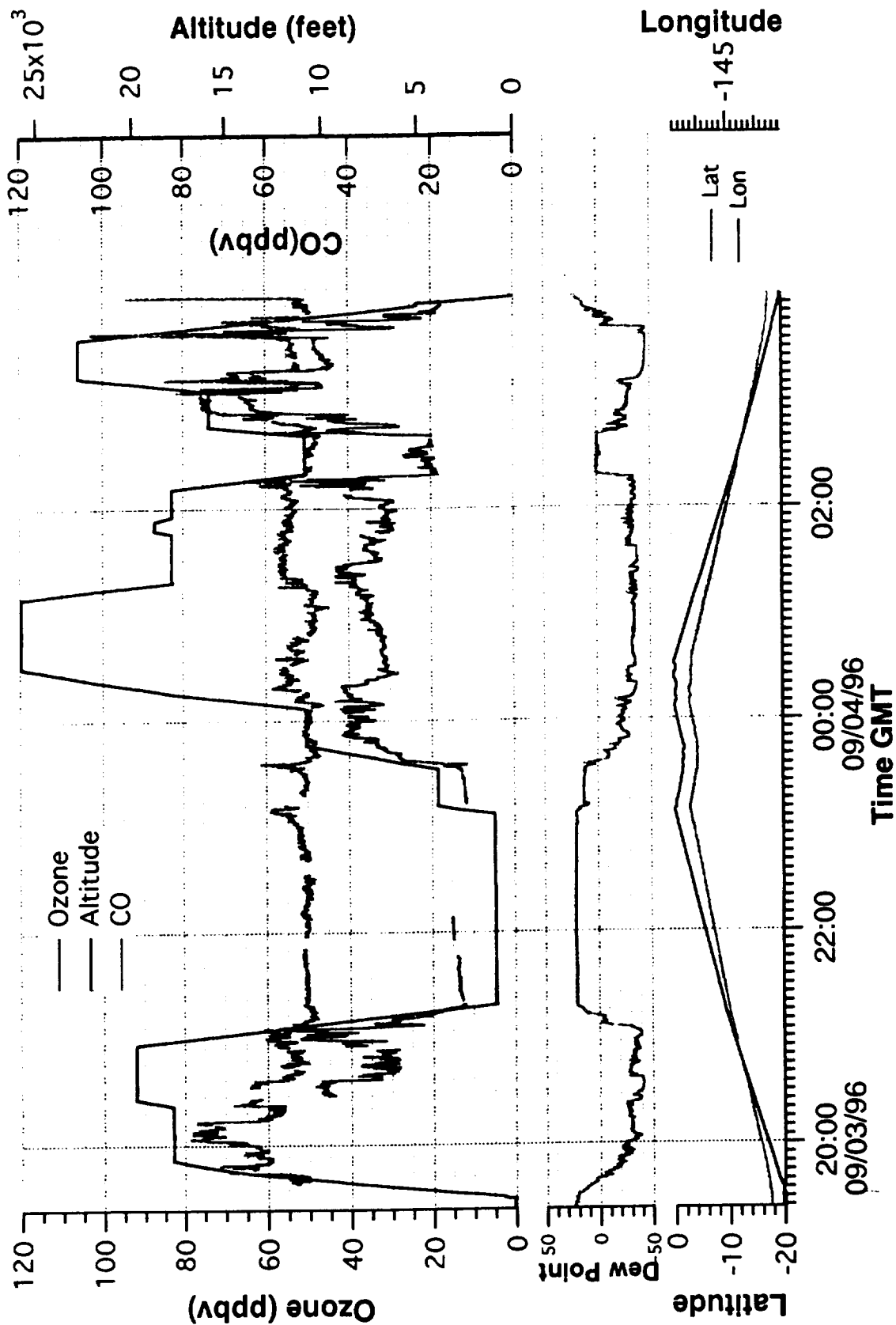
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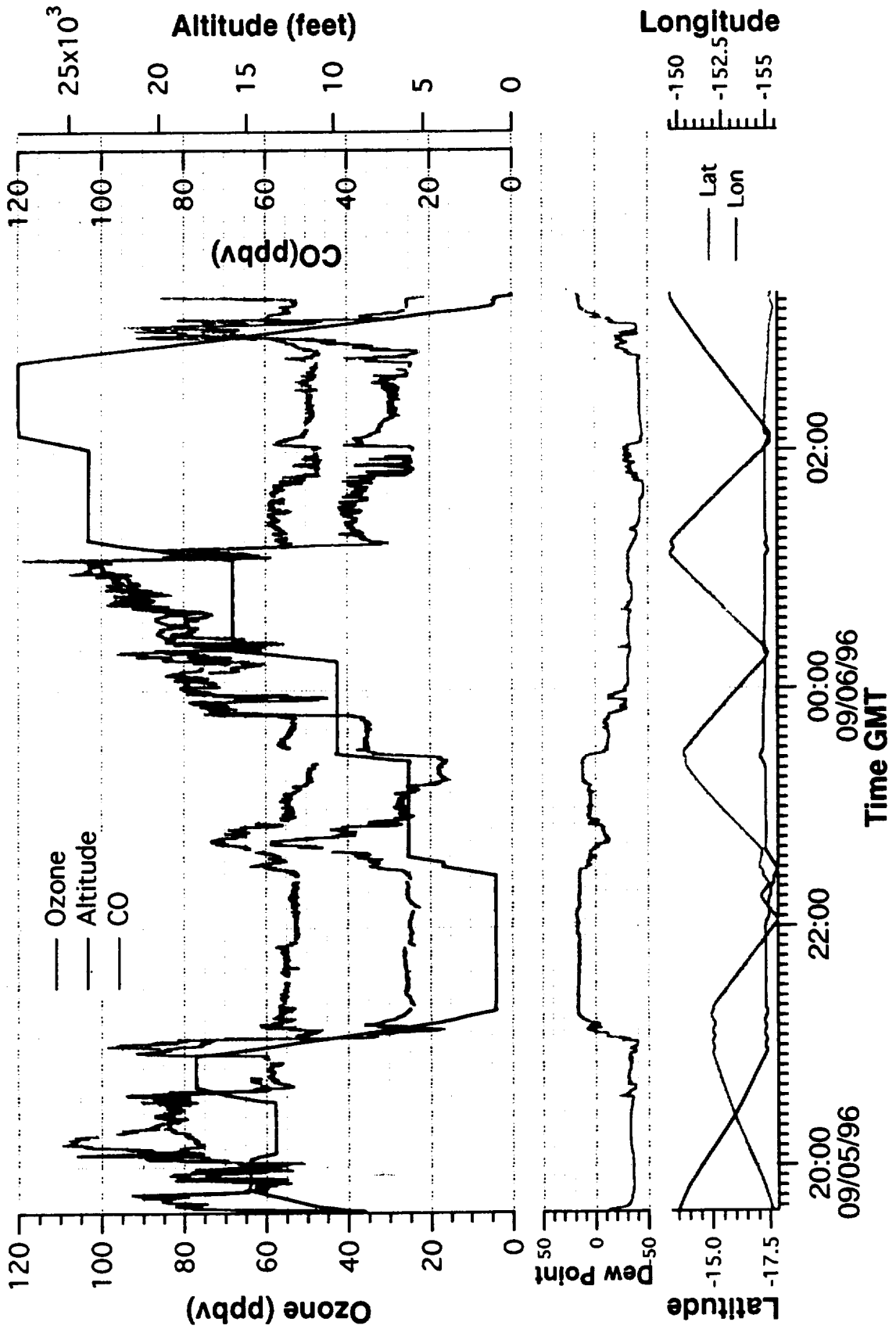
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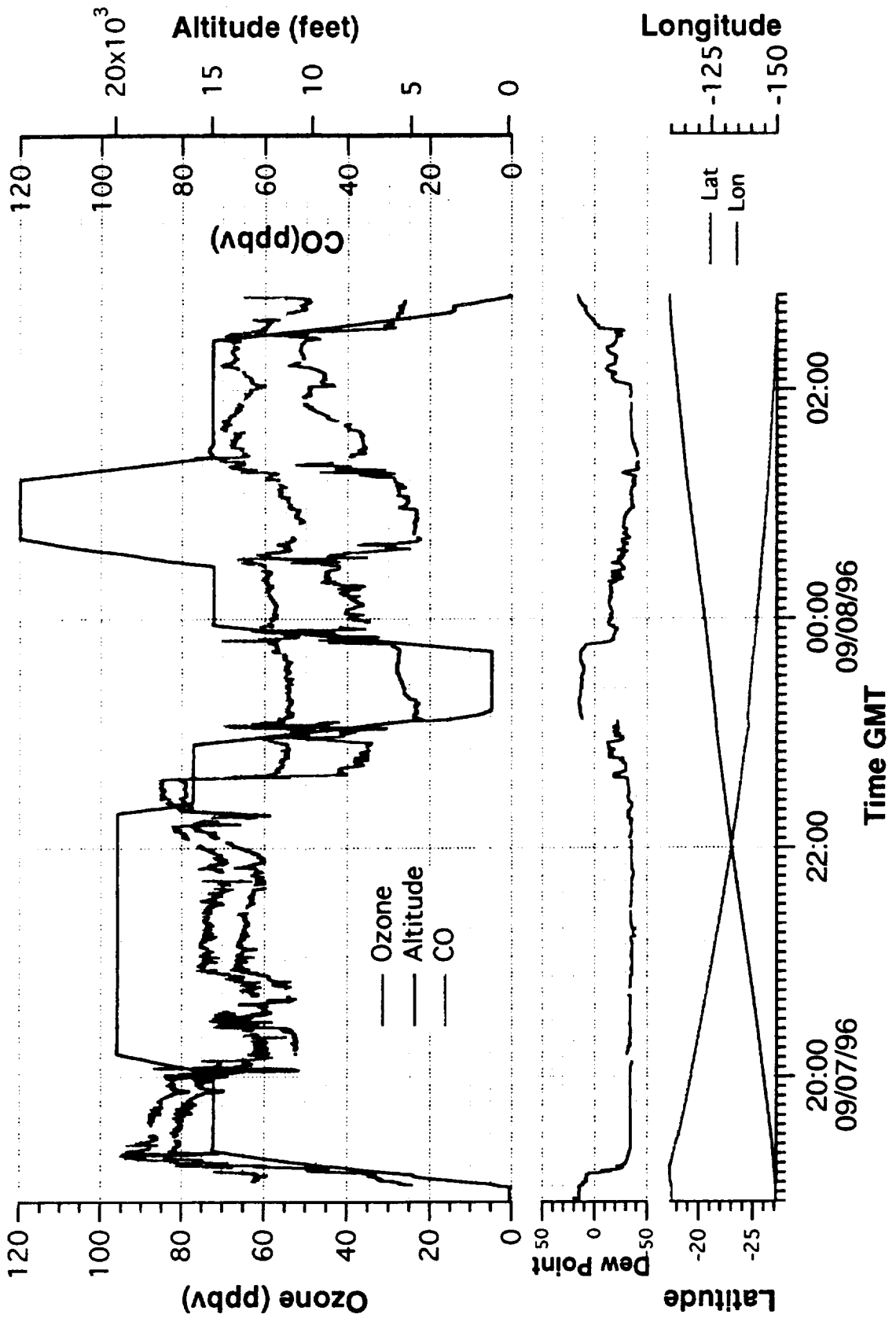
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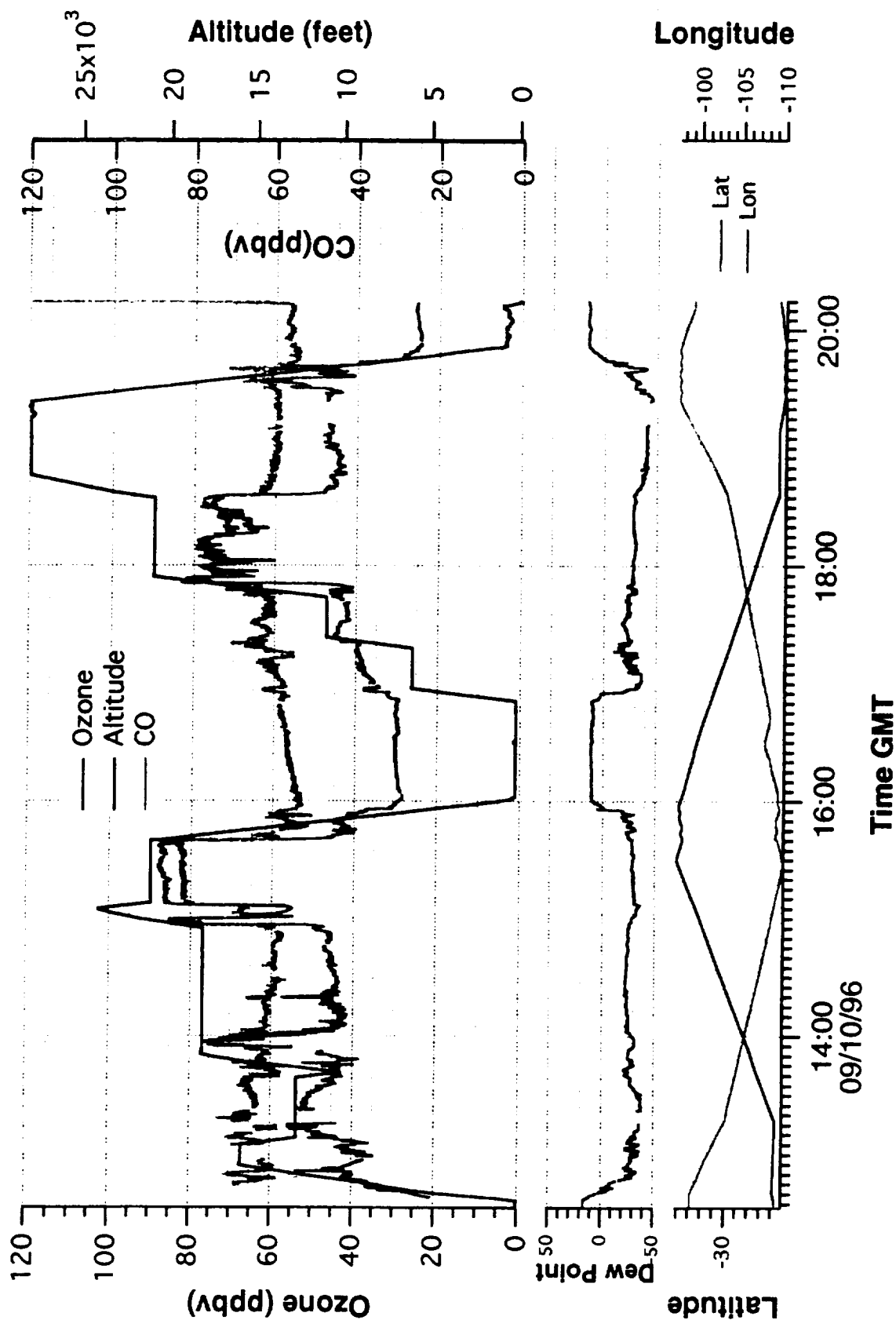
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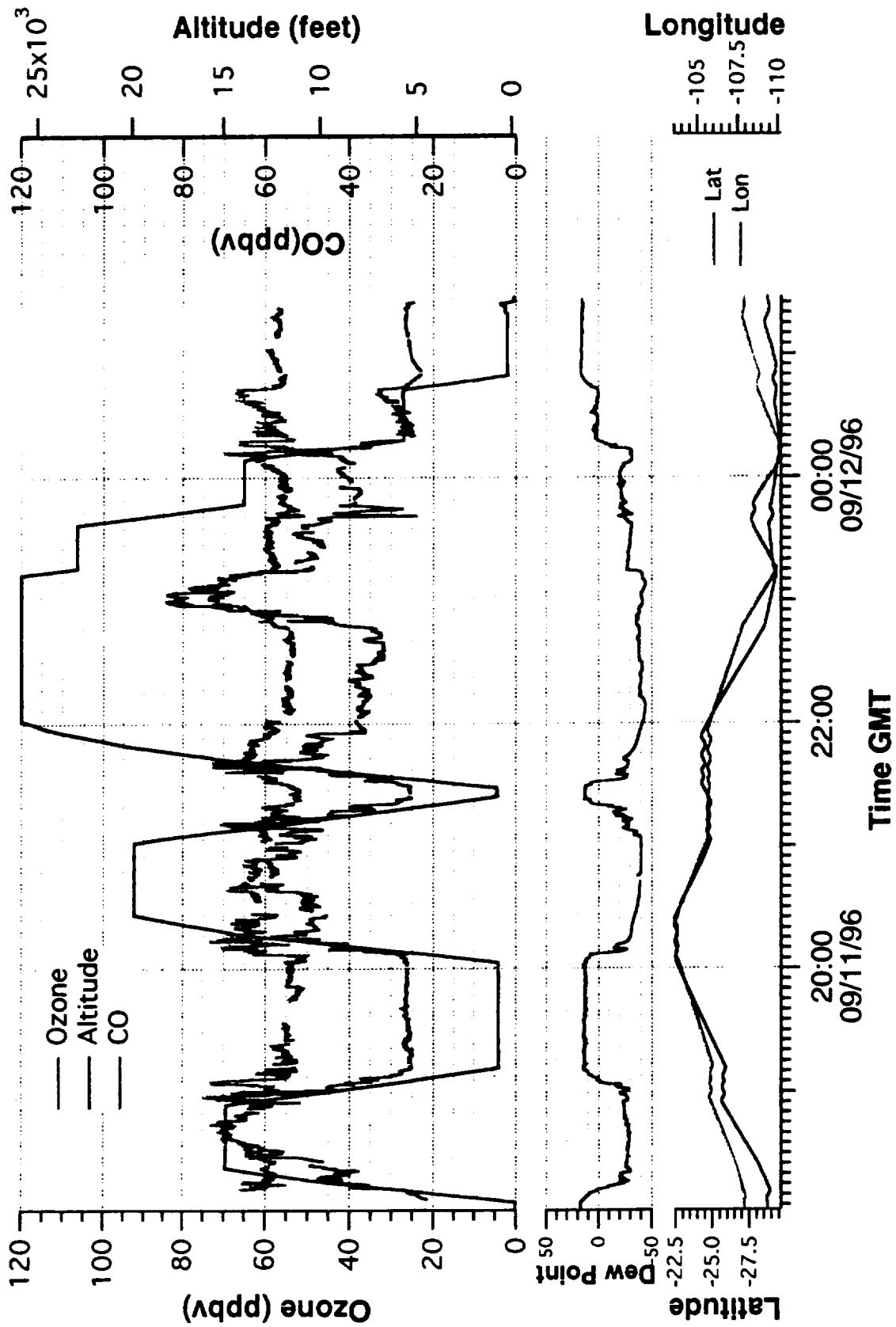
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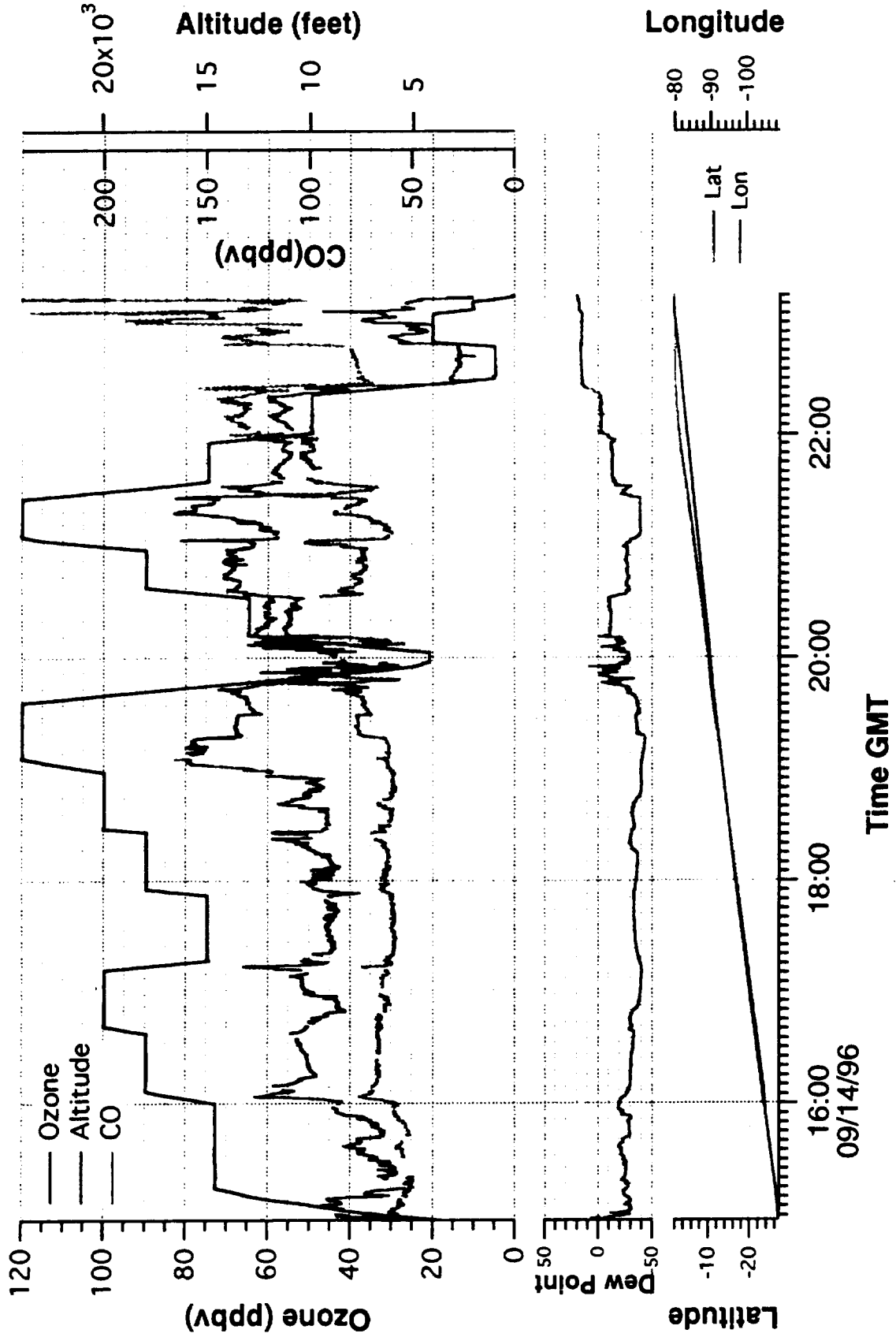
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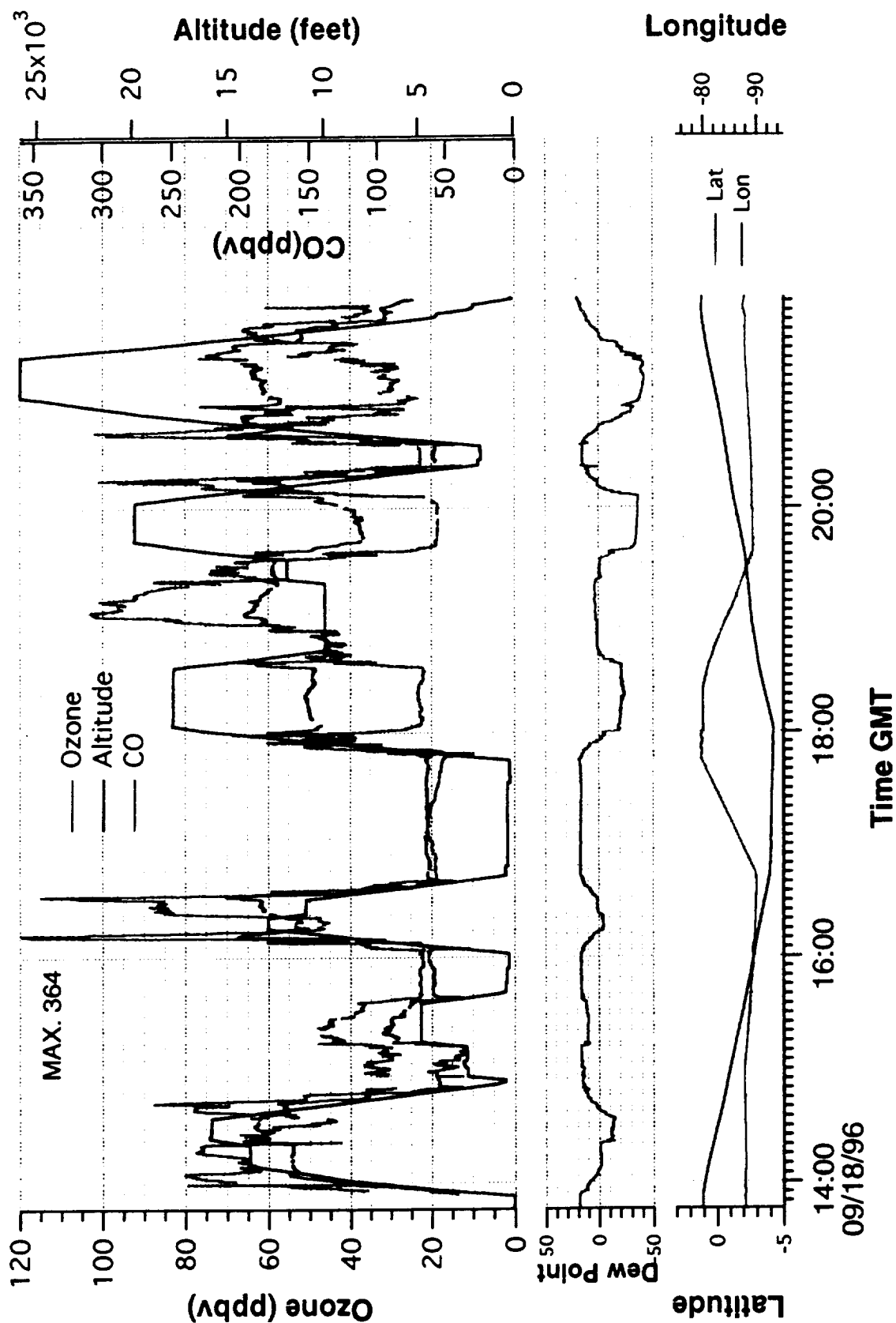
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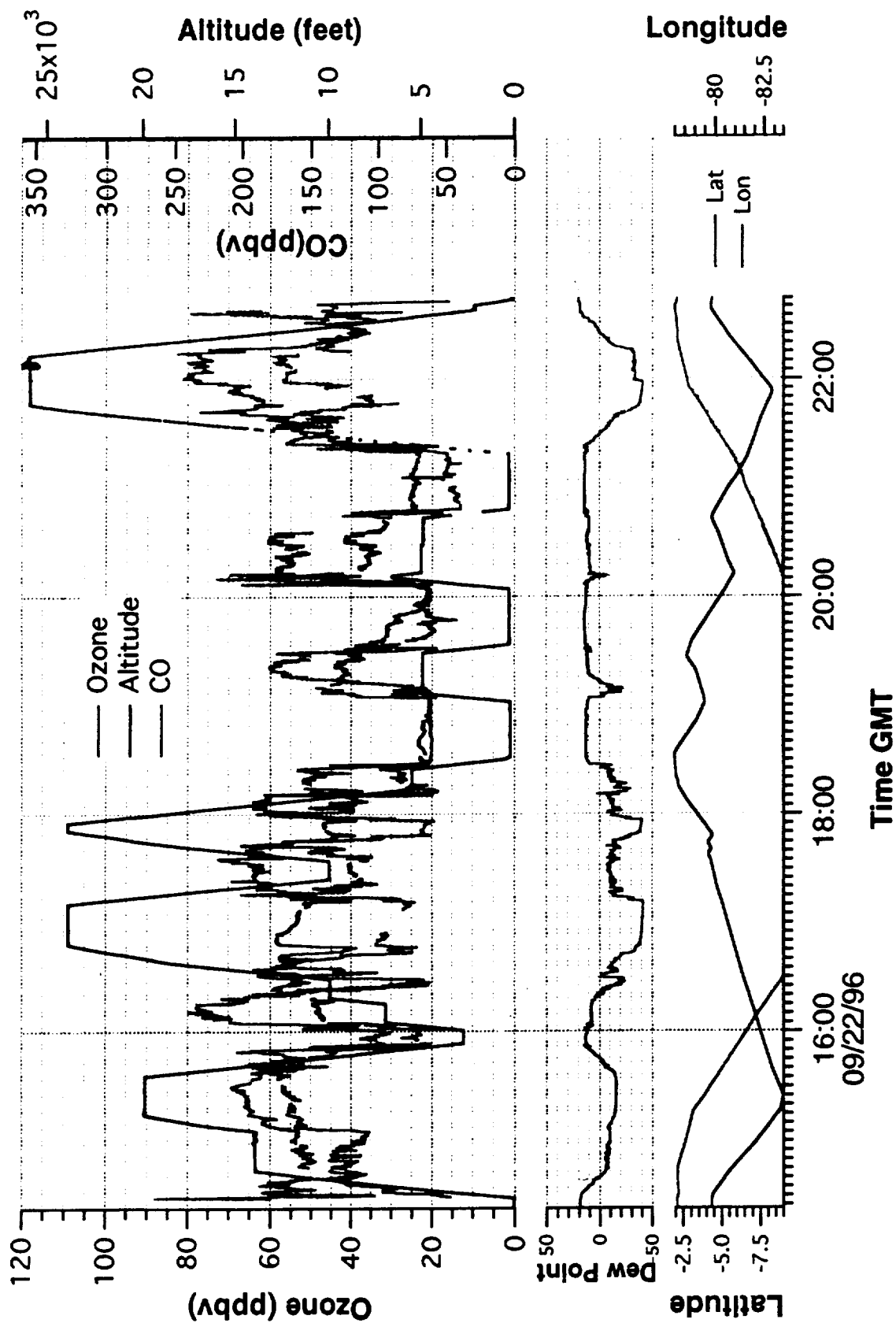
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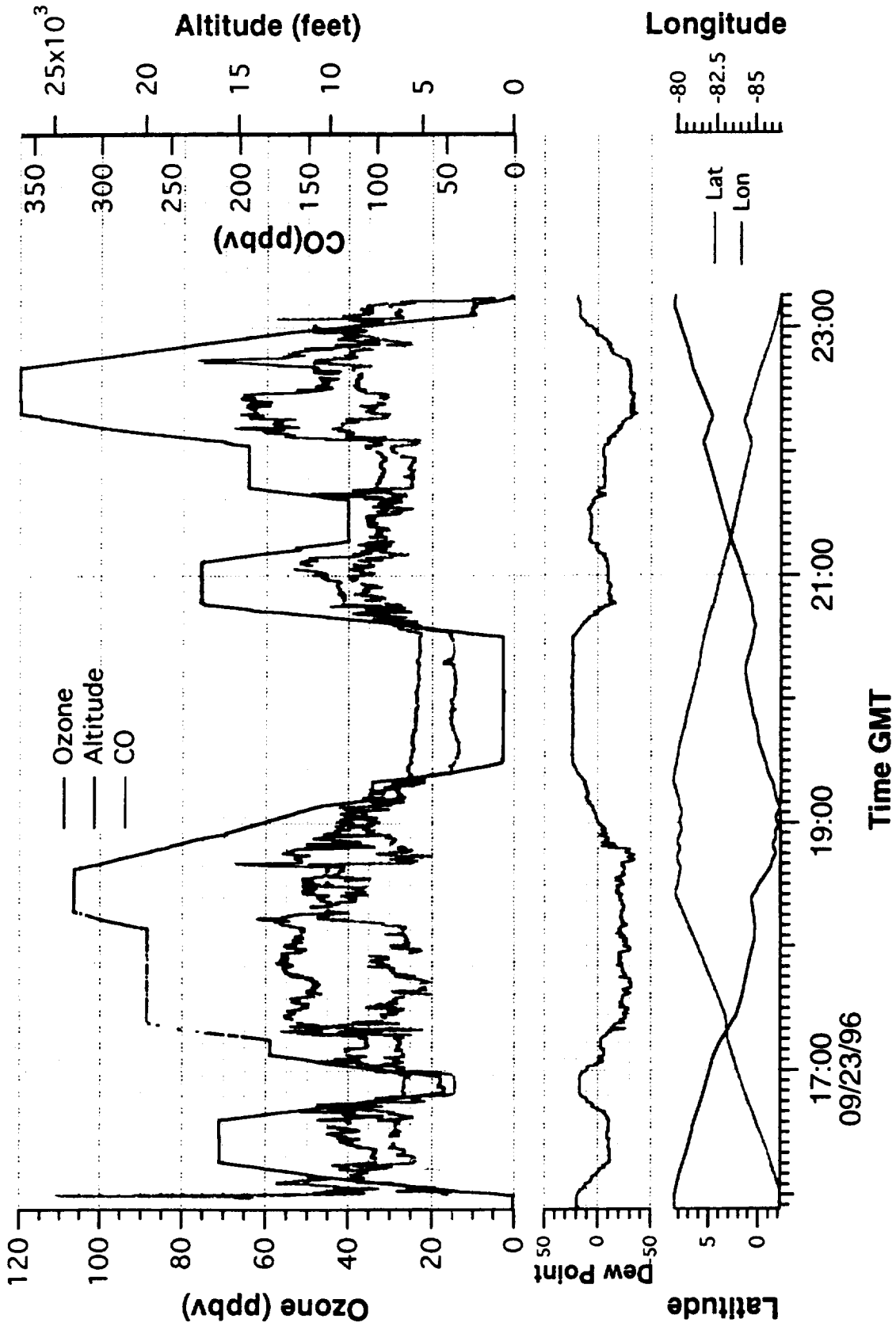
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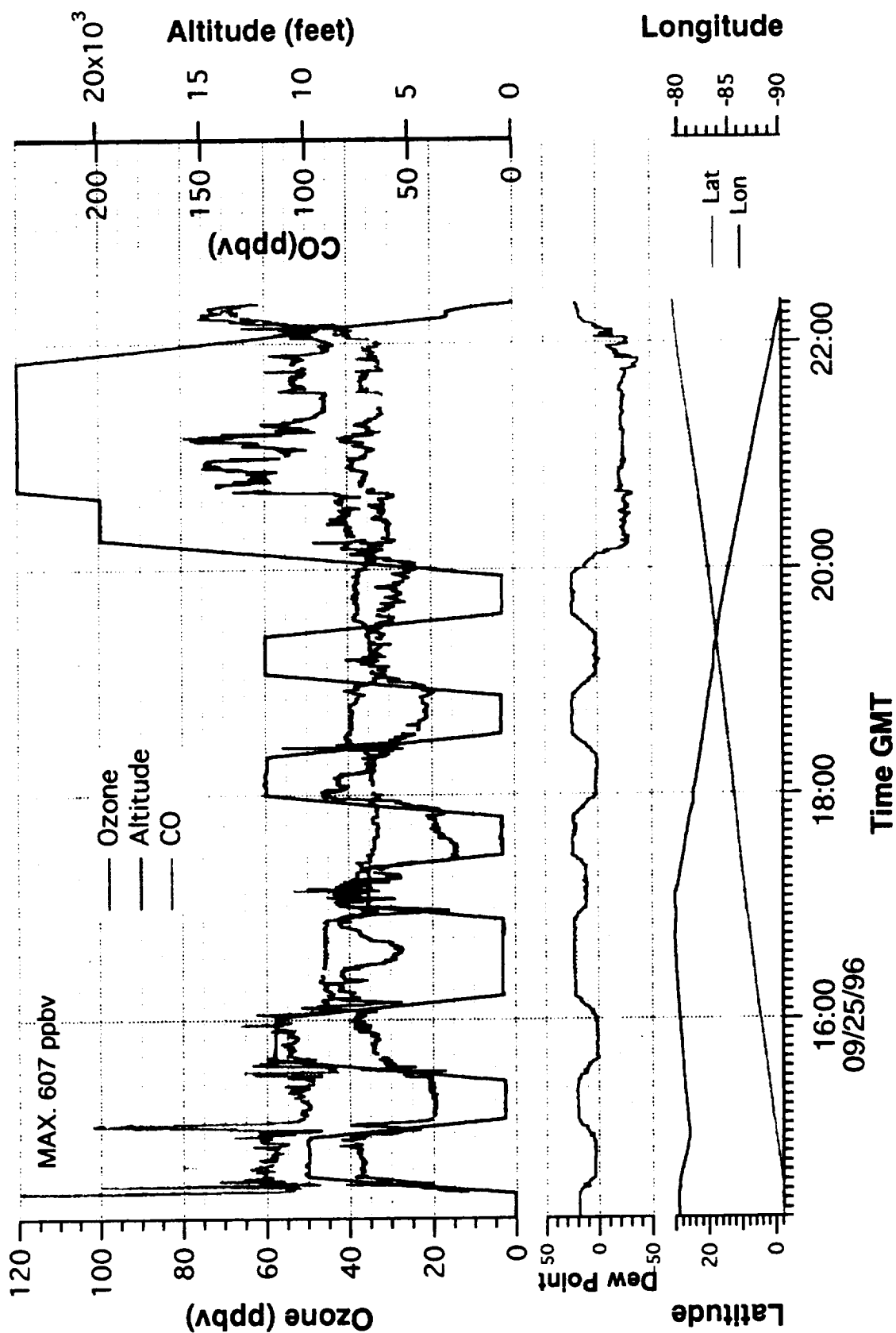
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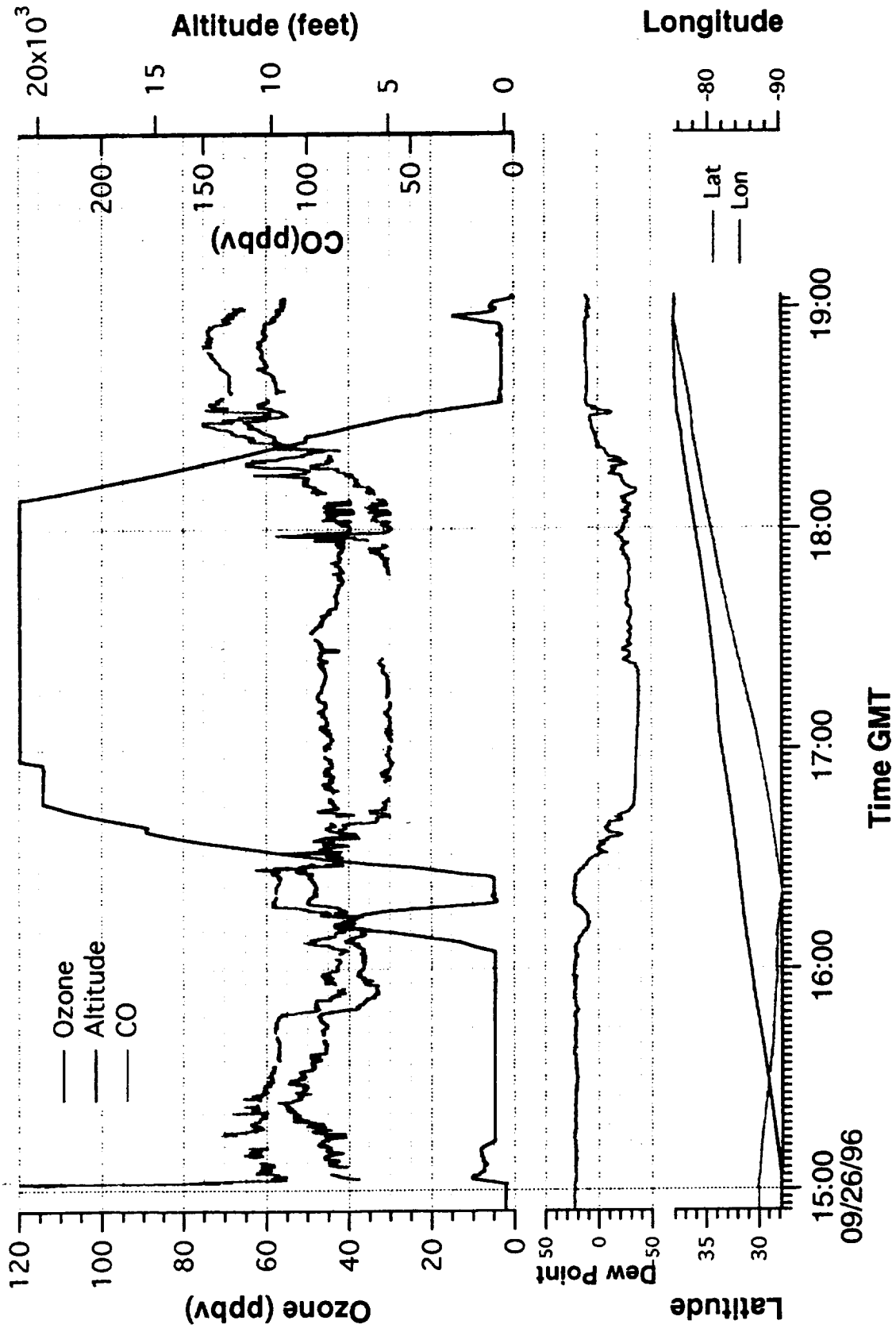
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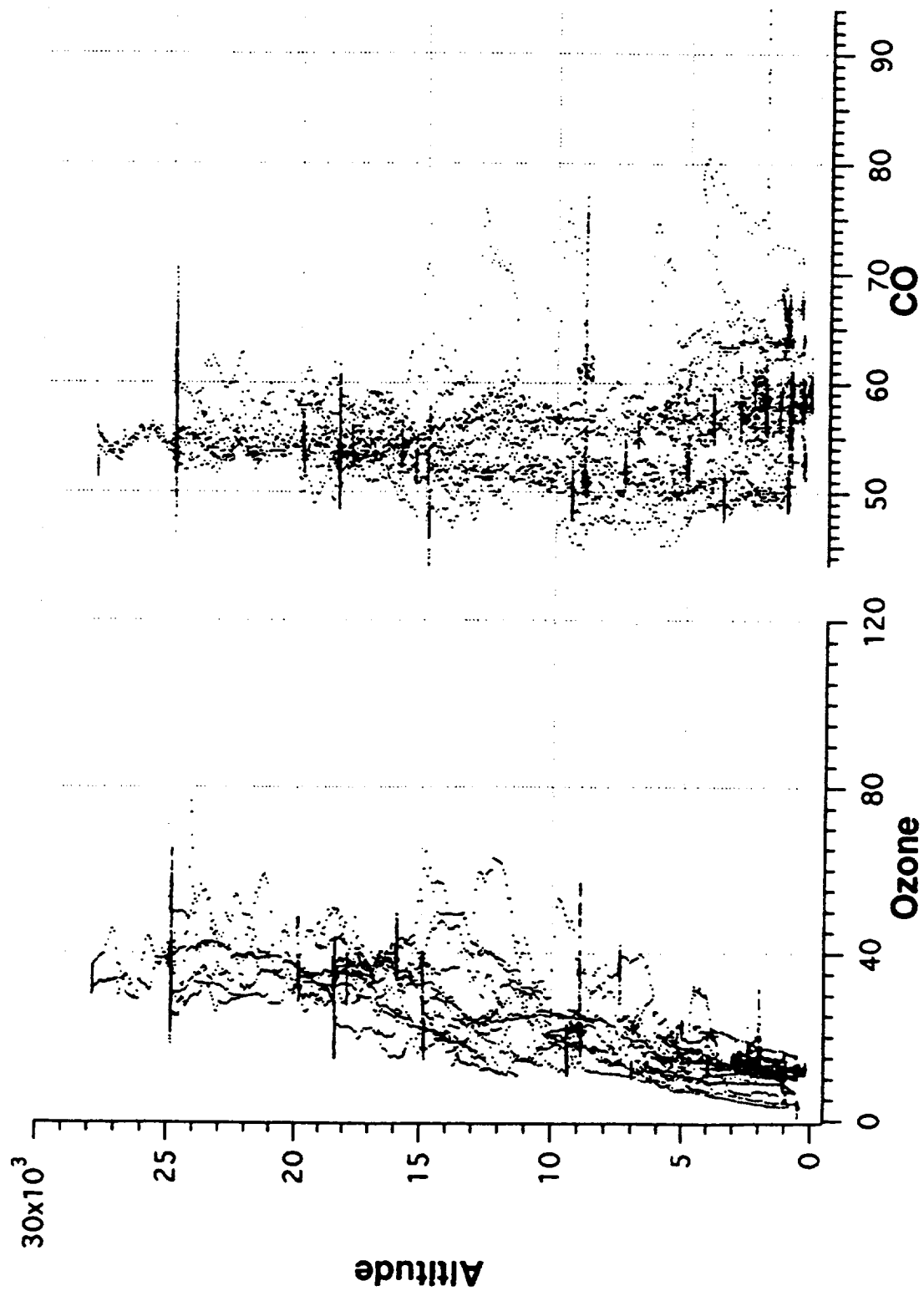
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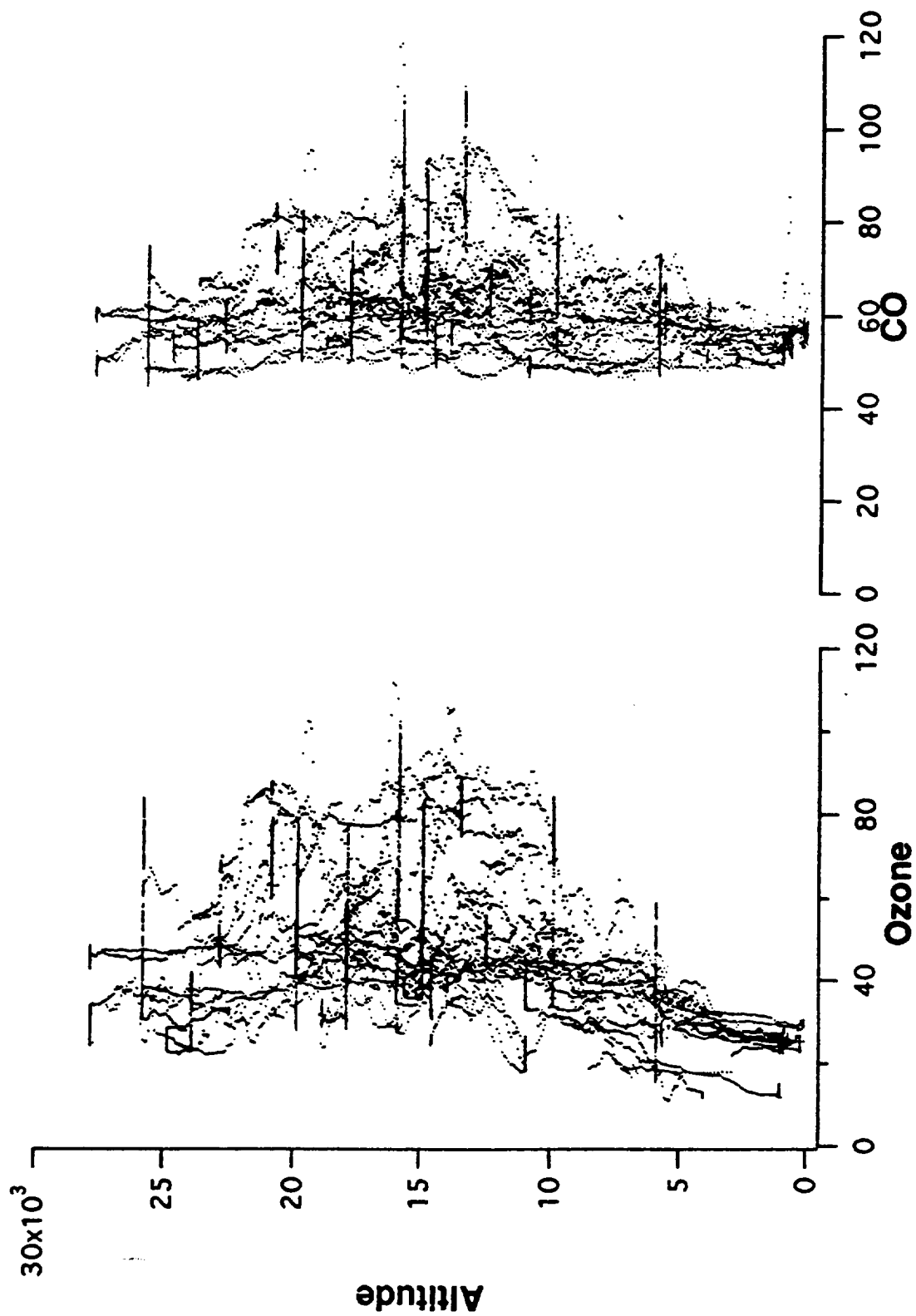
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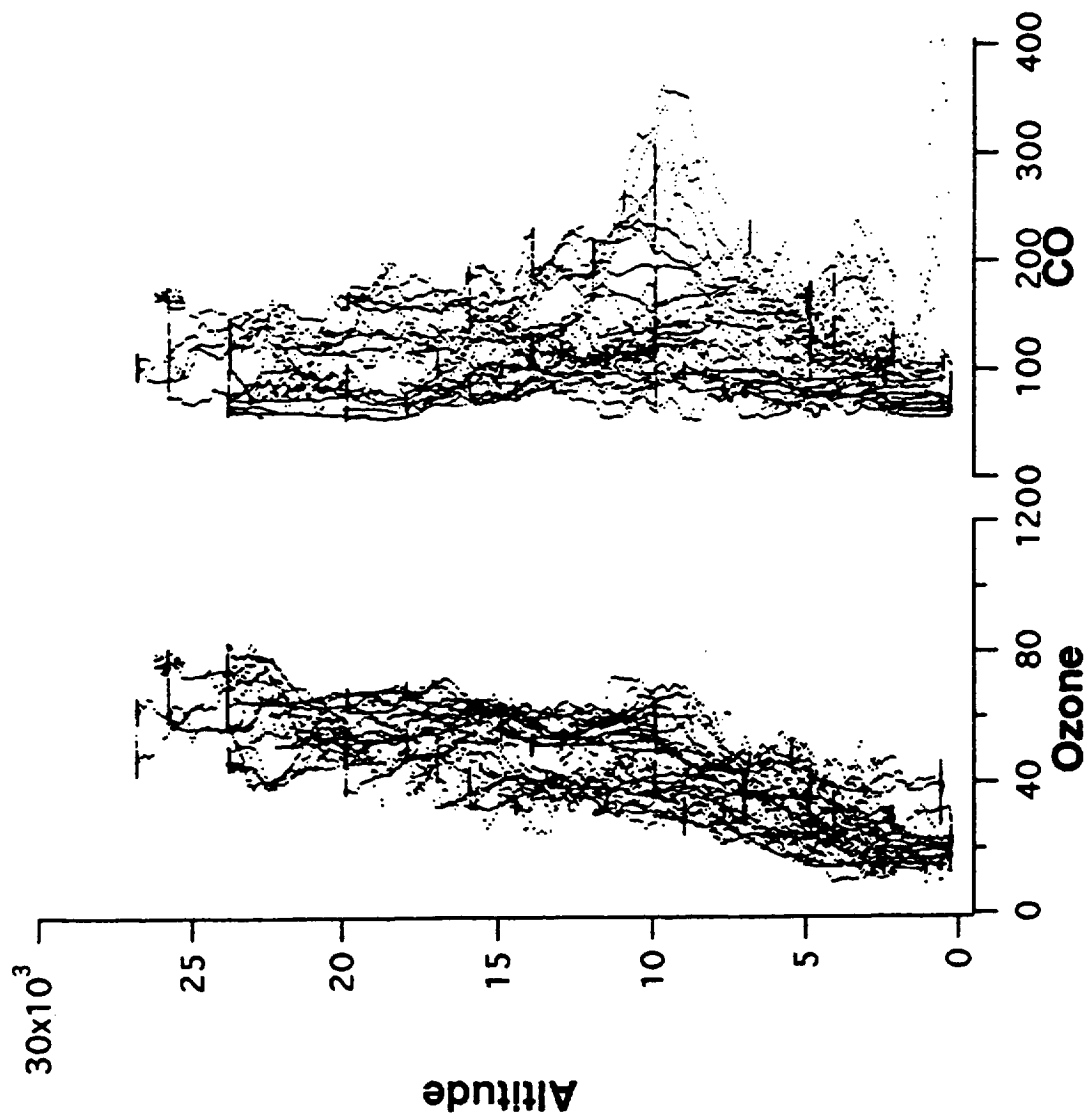
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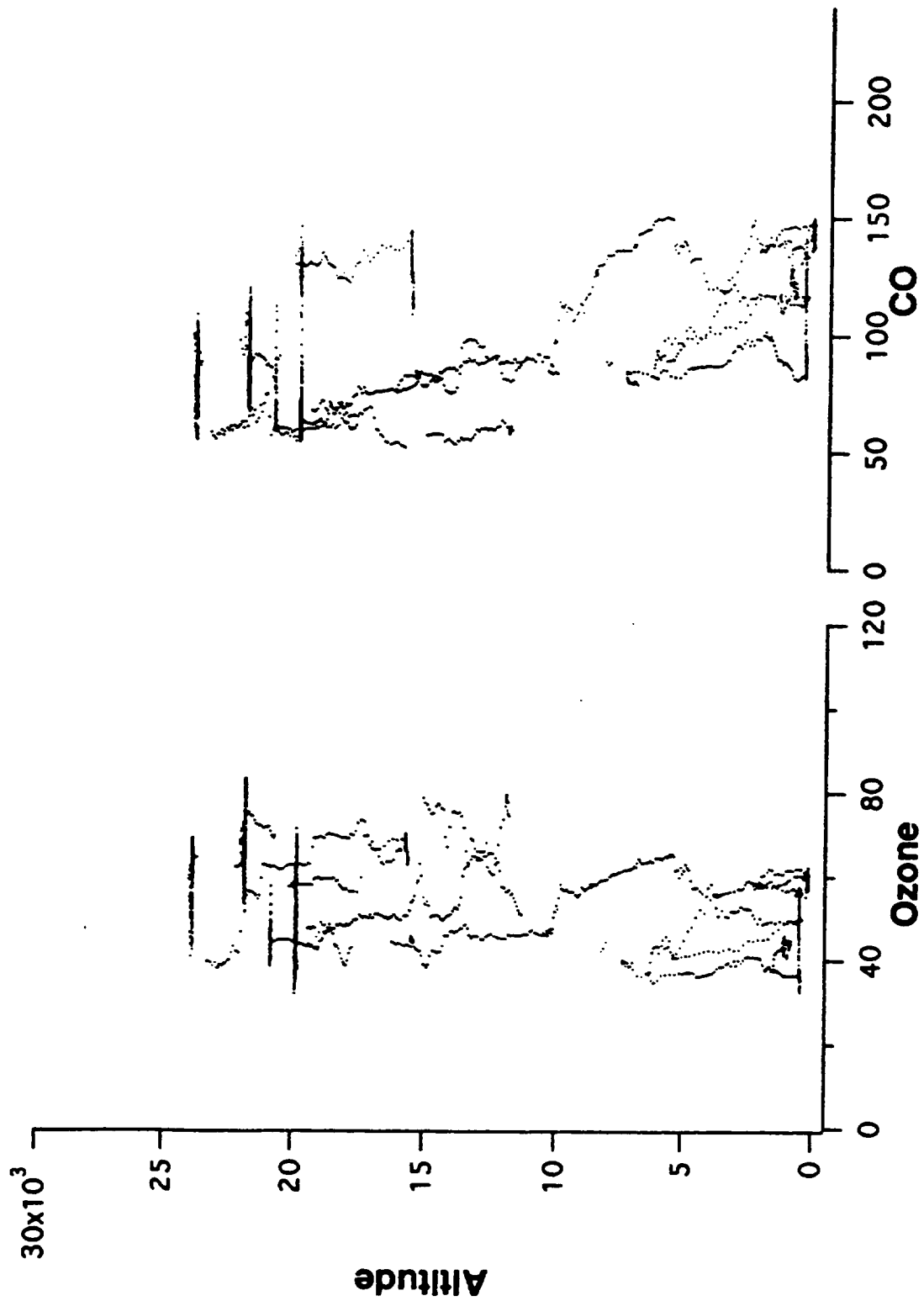
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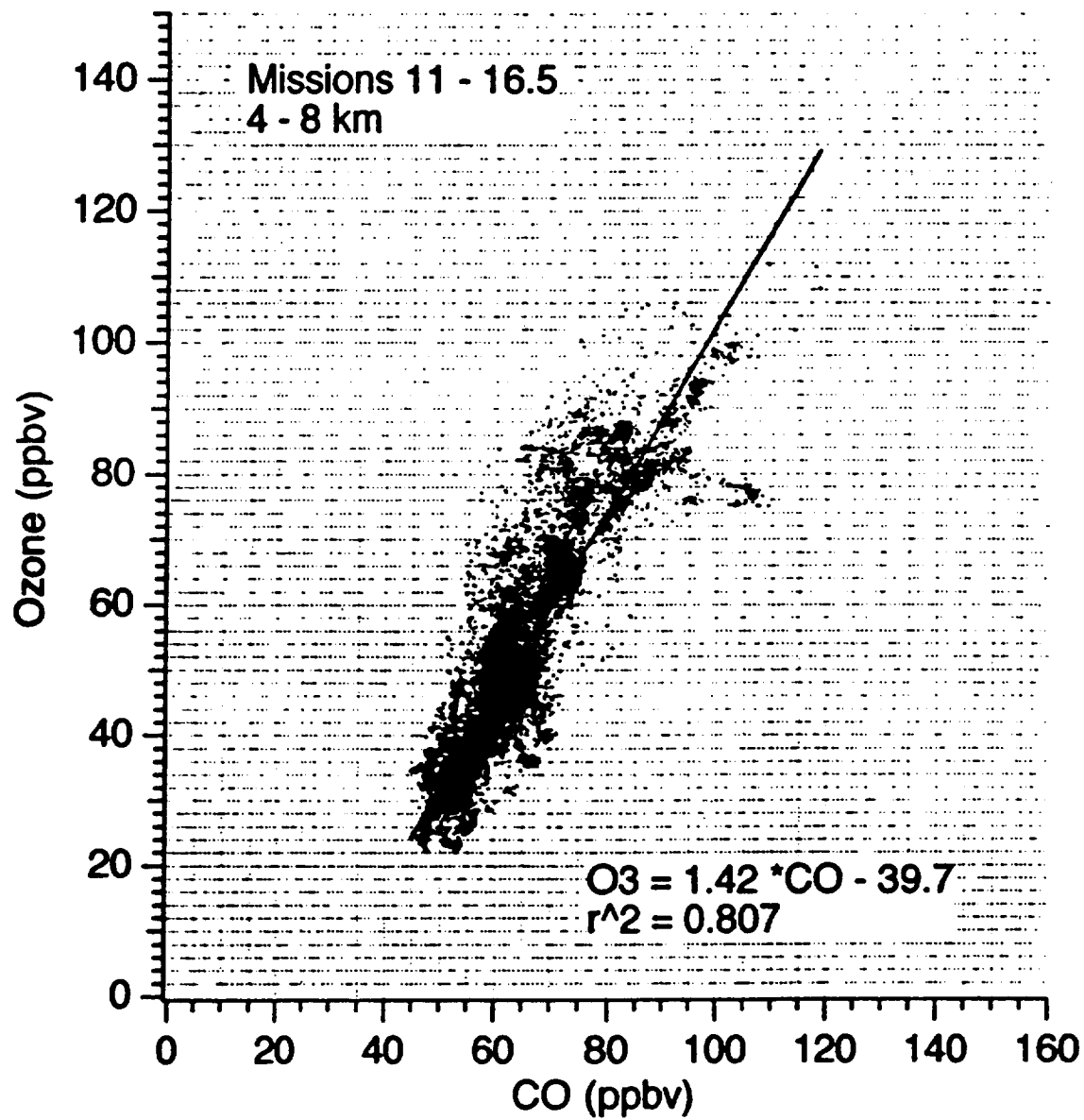


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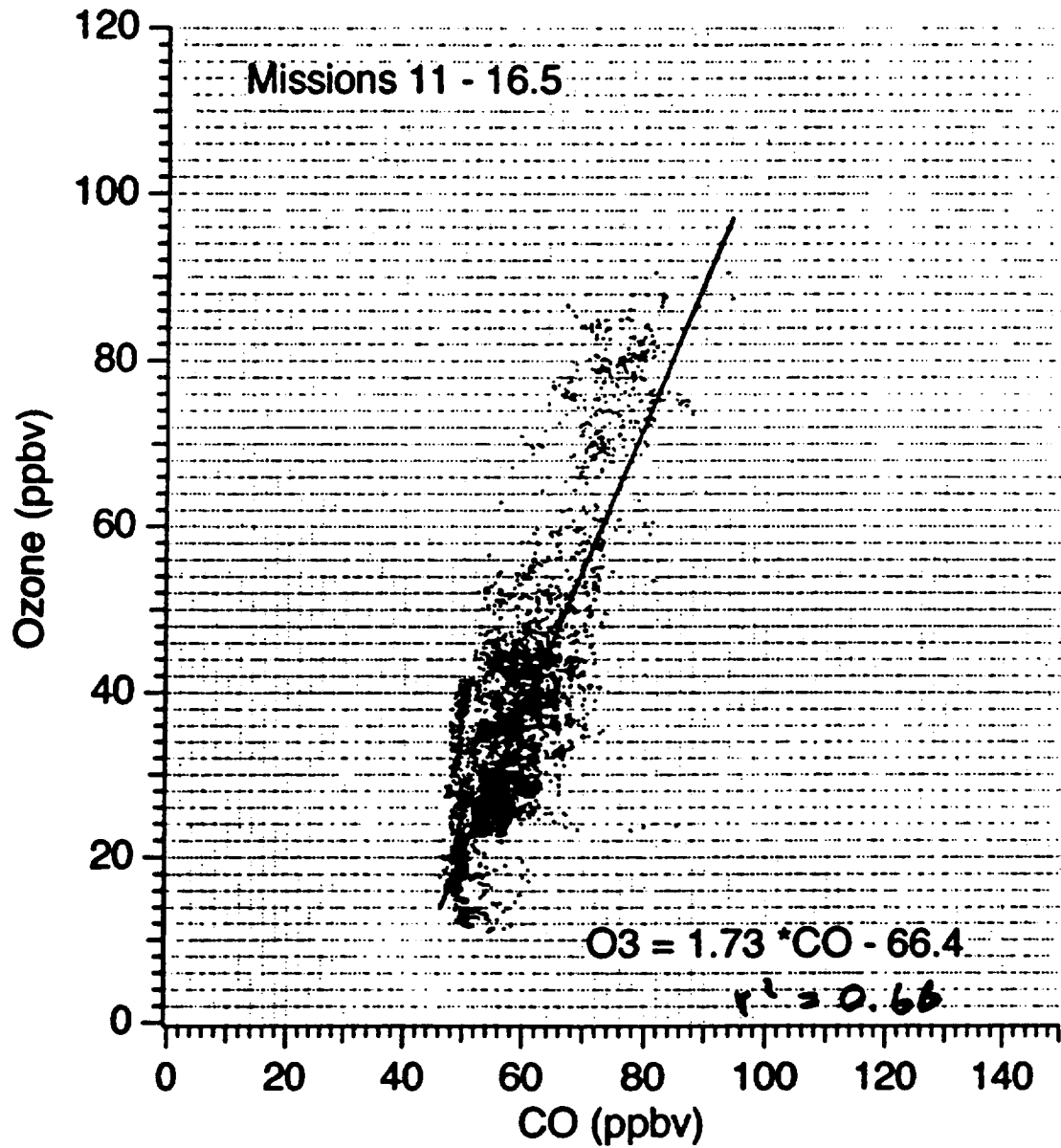


Missions #4 & 21





0-4 km



Data-Model Comparison Regions

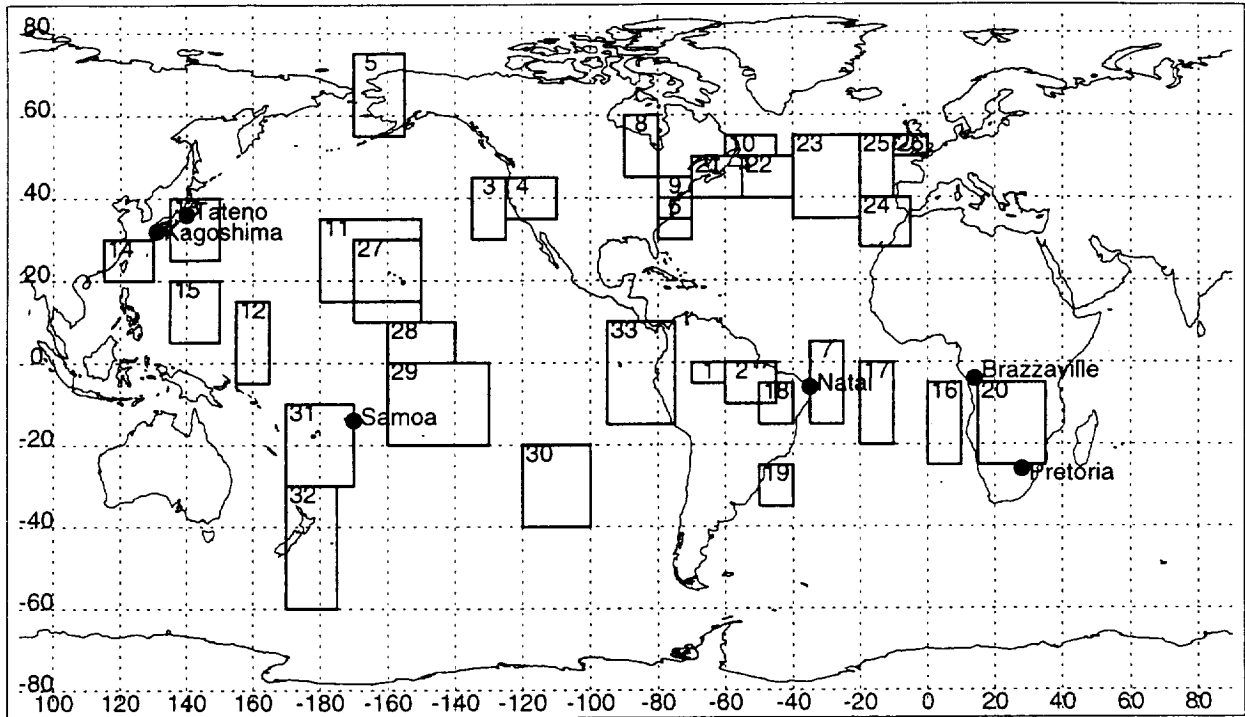


Fig.1

PEM-Tropics - Tahiti

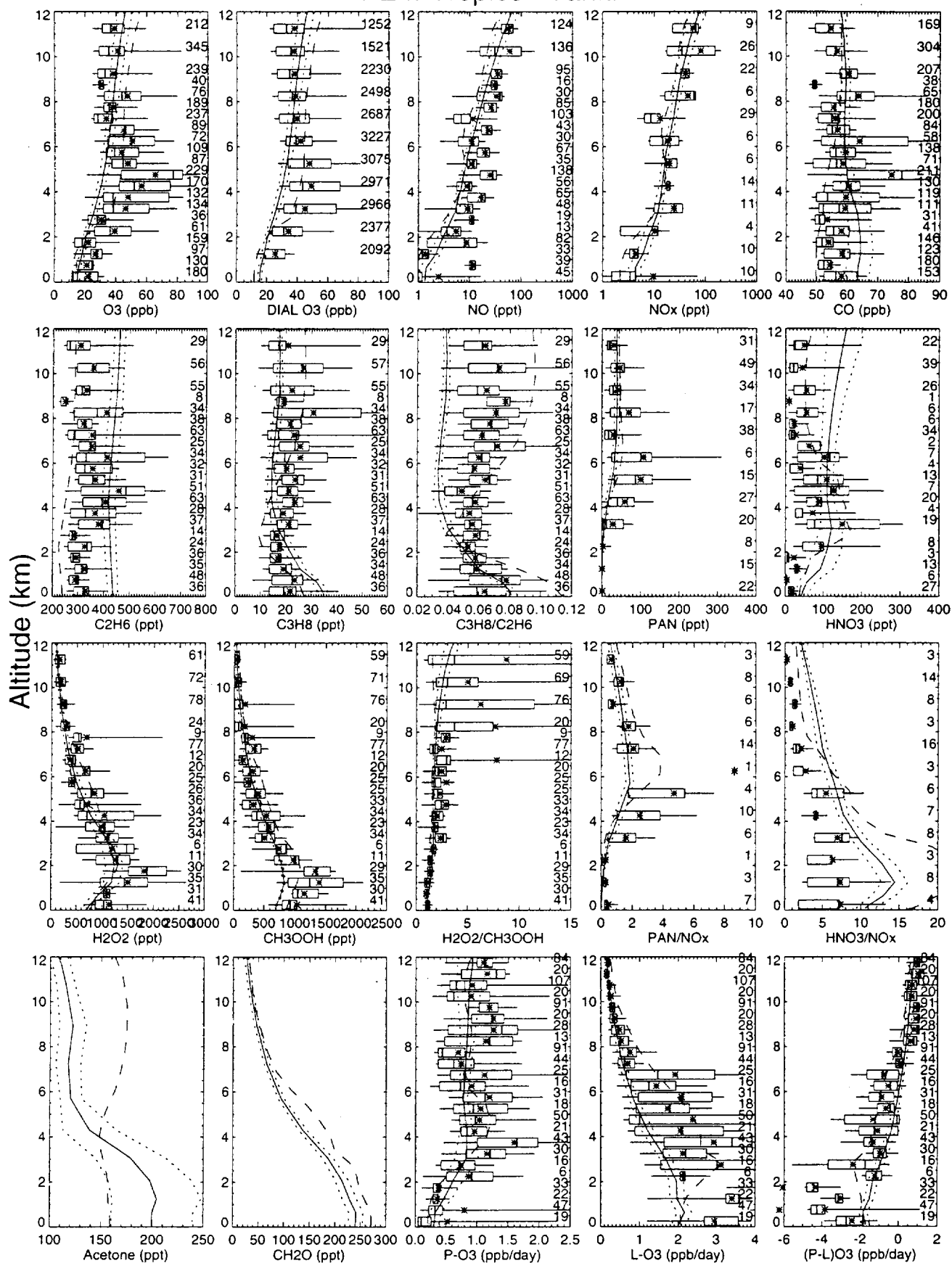


Fig. 4

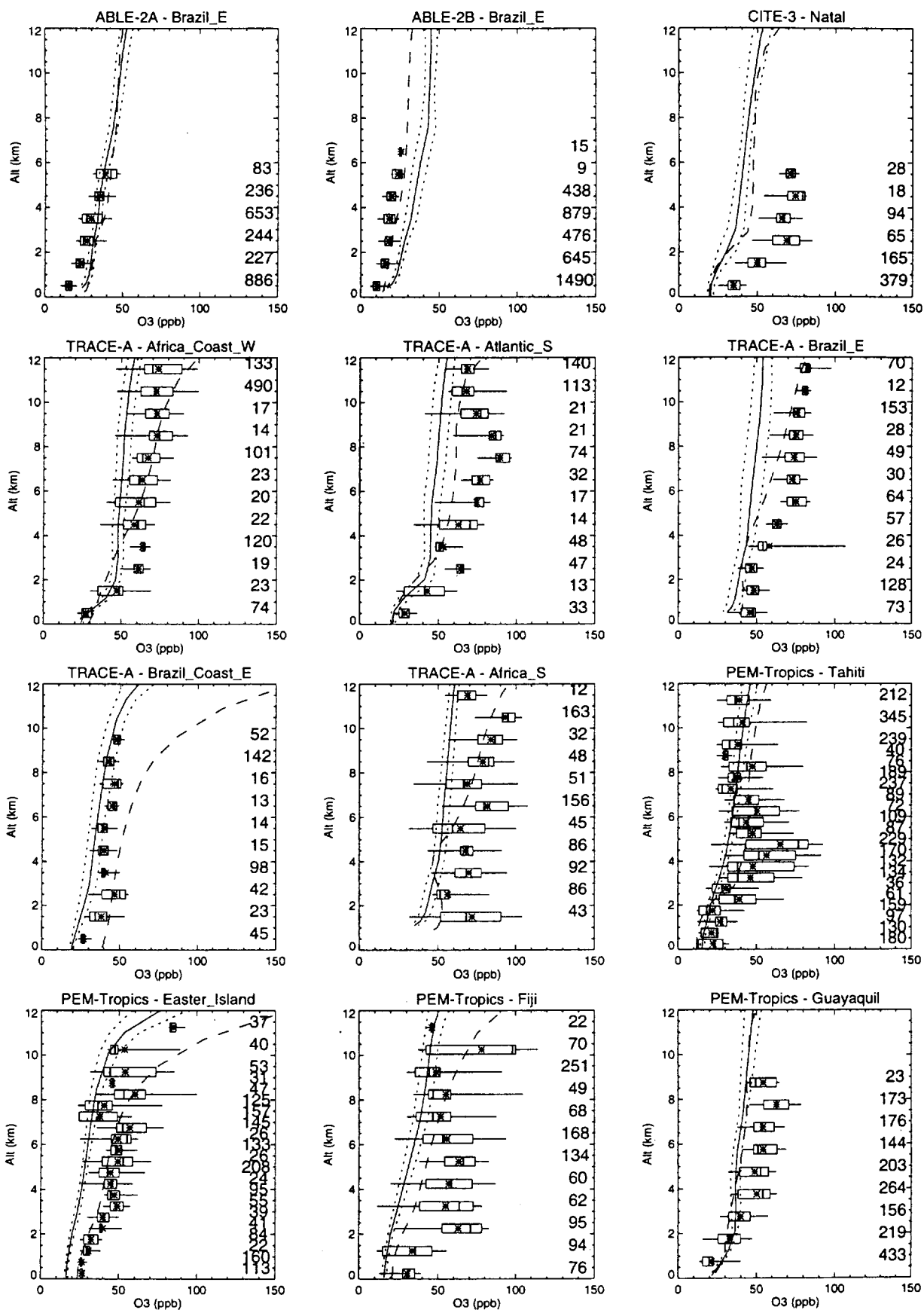


Fig. 8

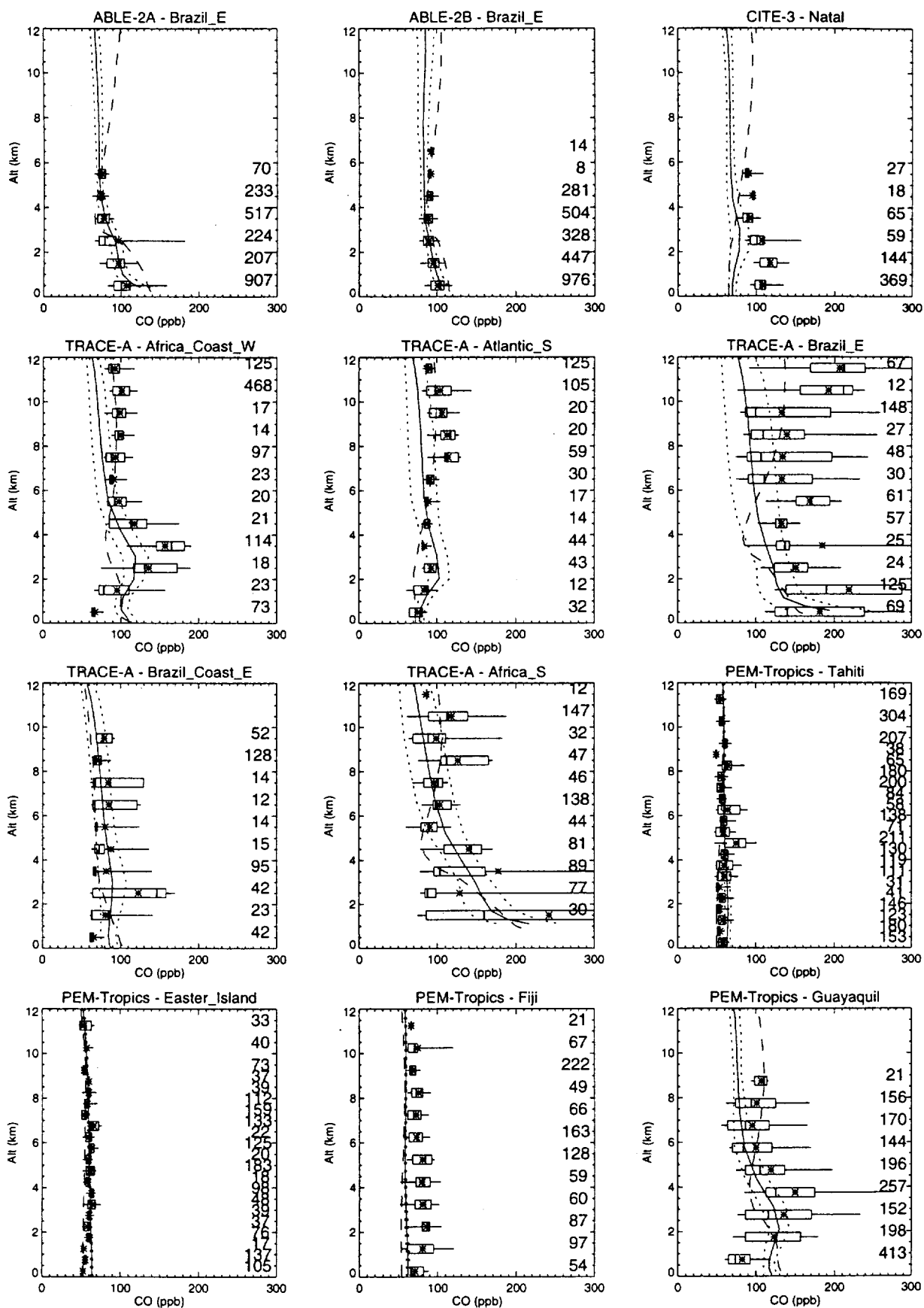


Fig. 9

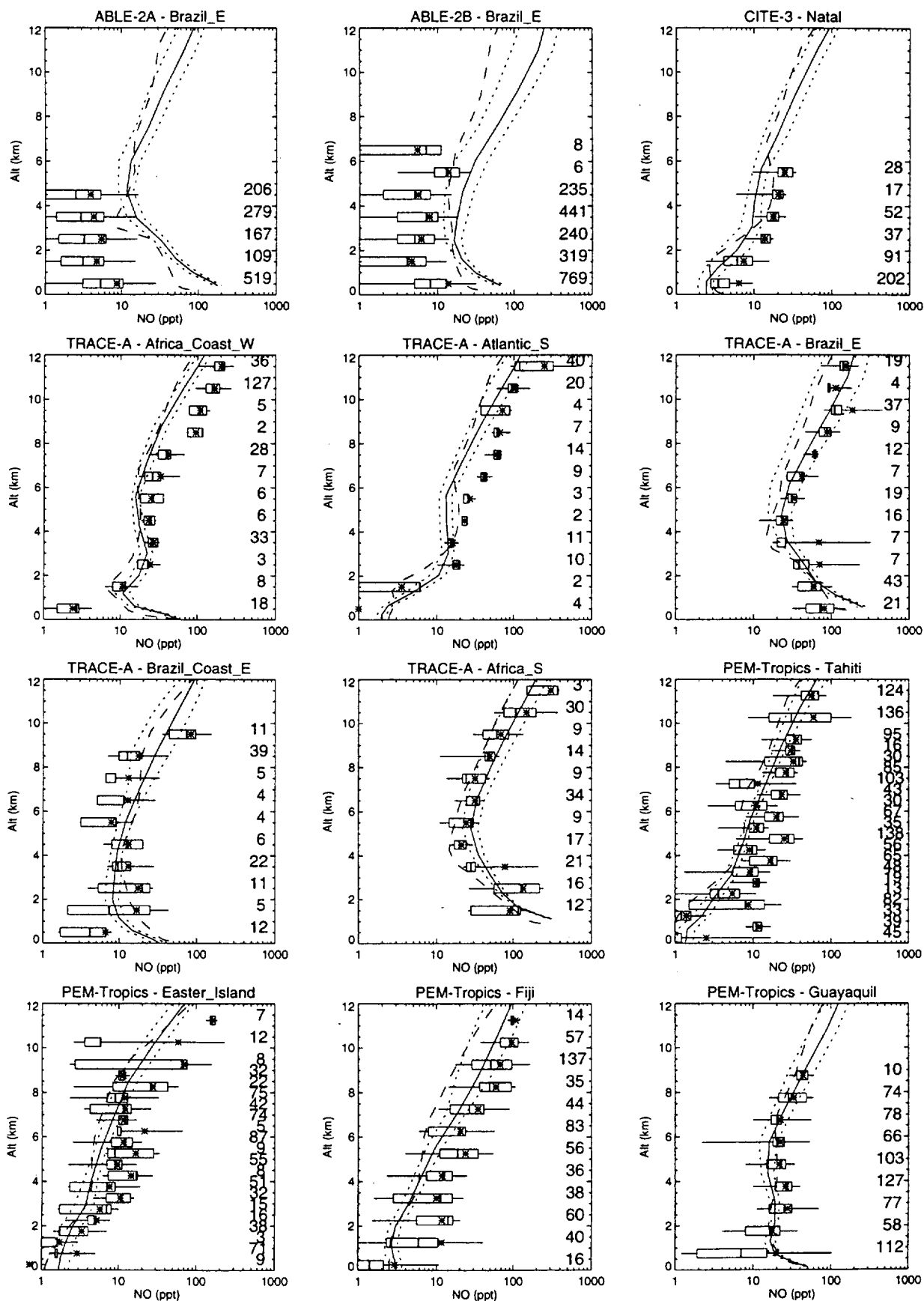


Fig. 10

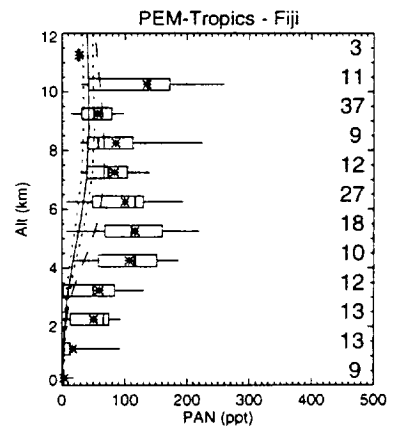
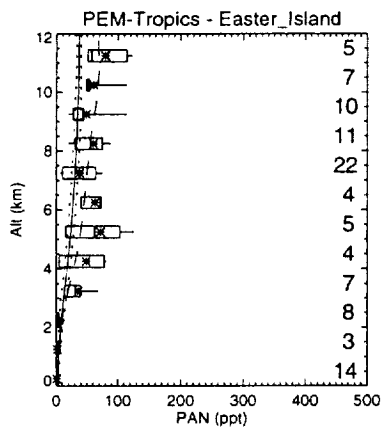
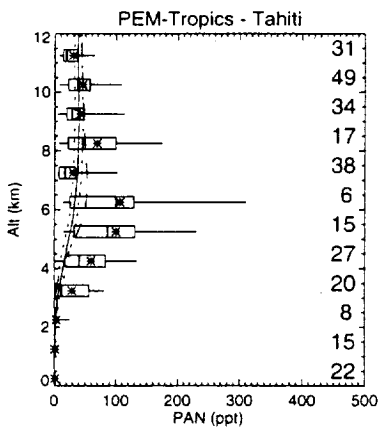
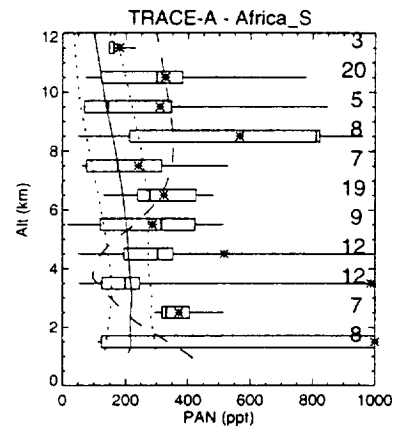
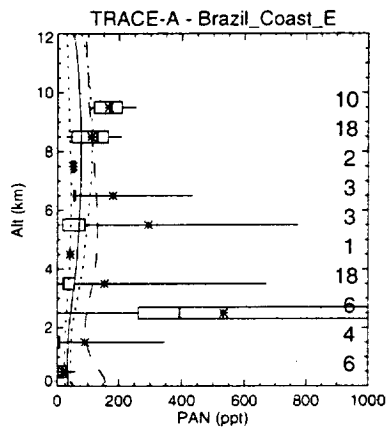
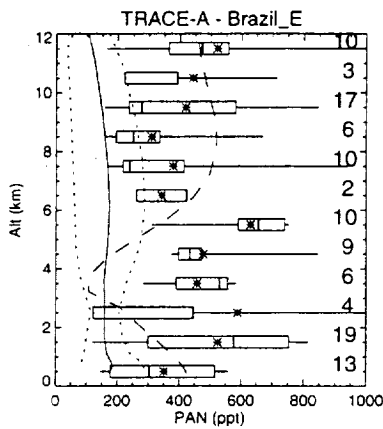
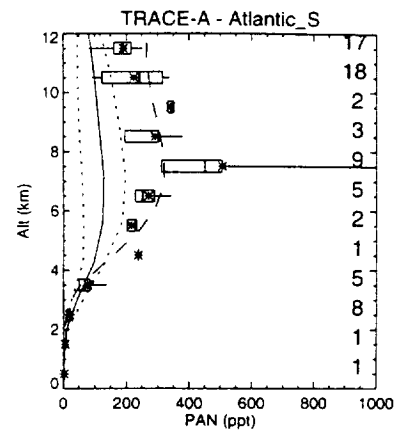
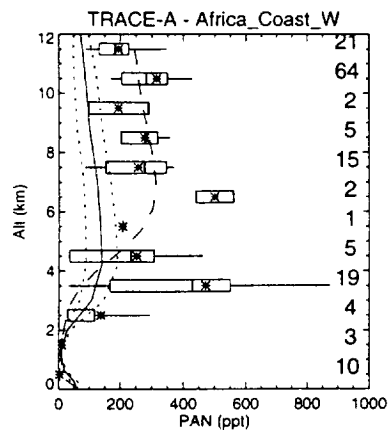
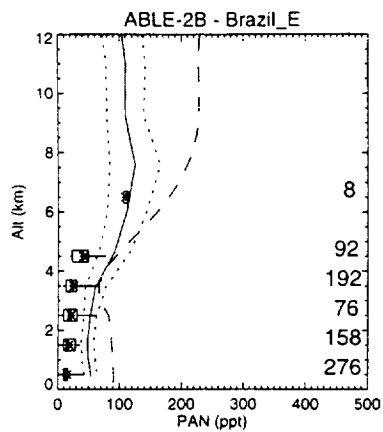


Fig. 11

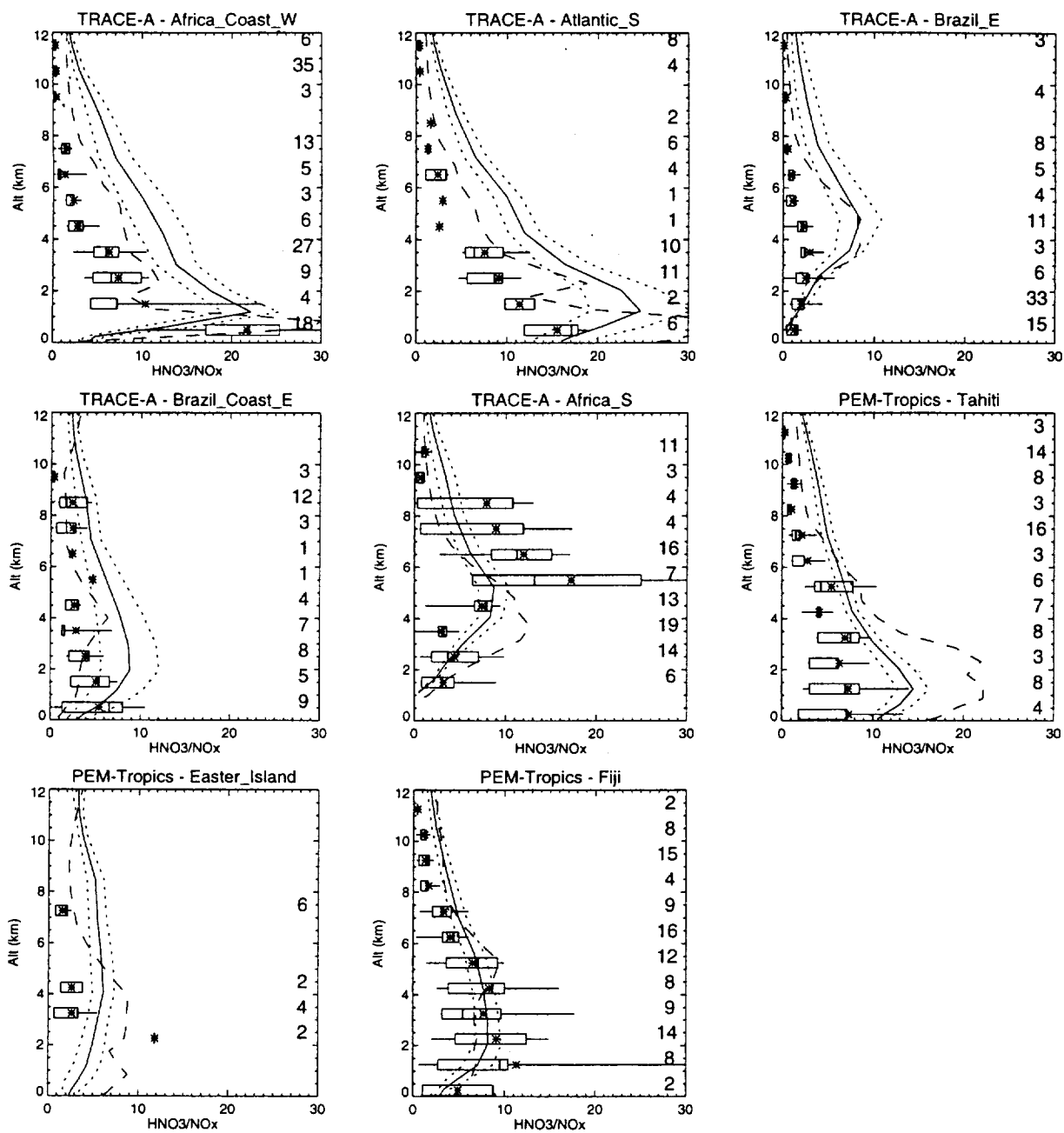
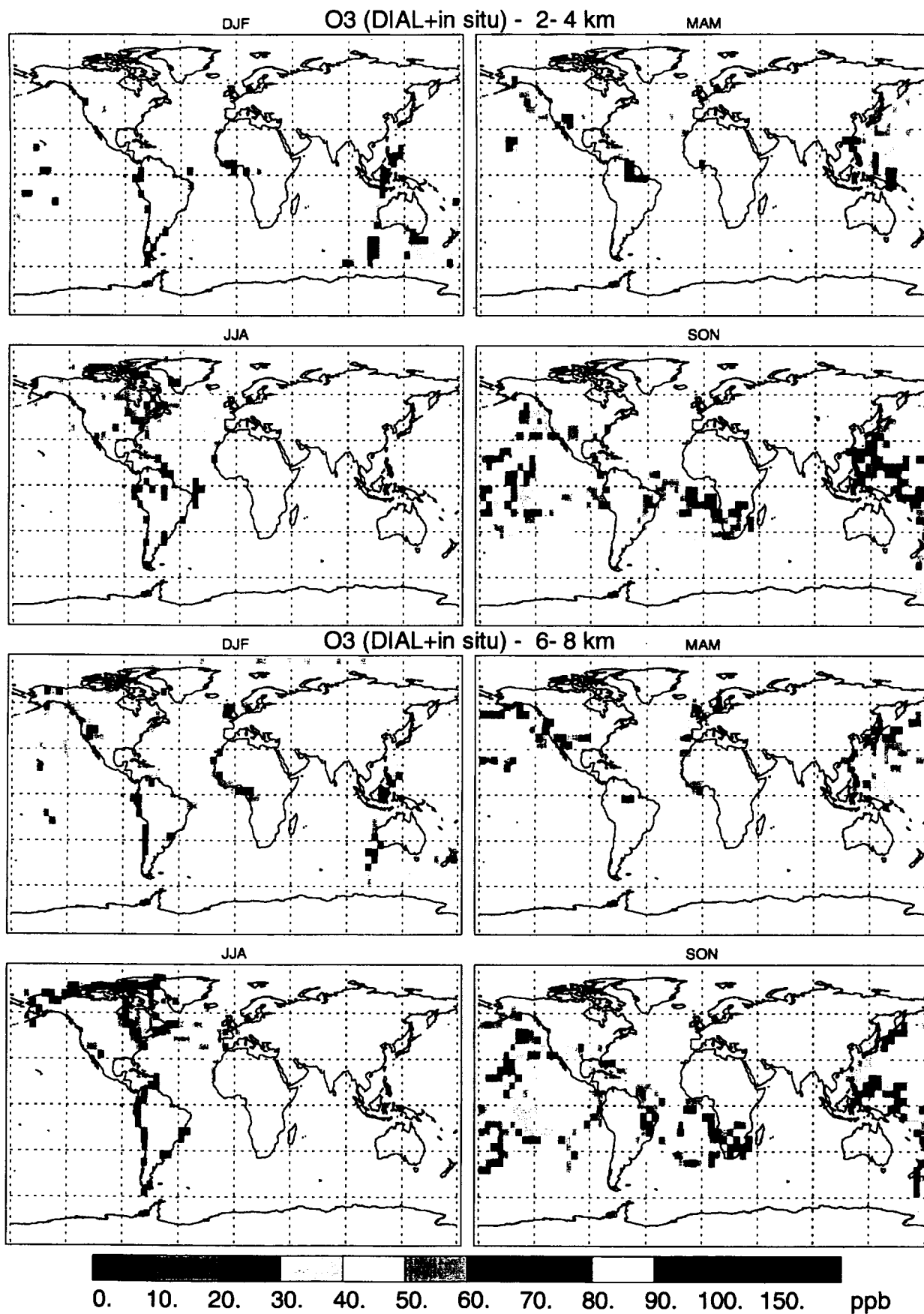
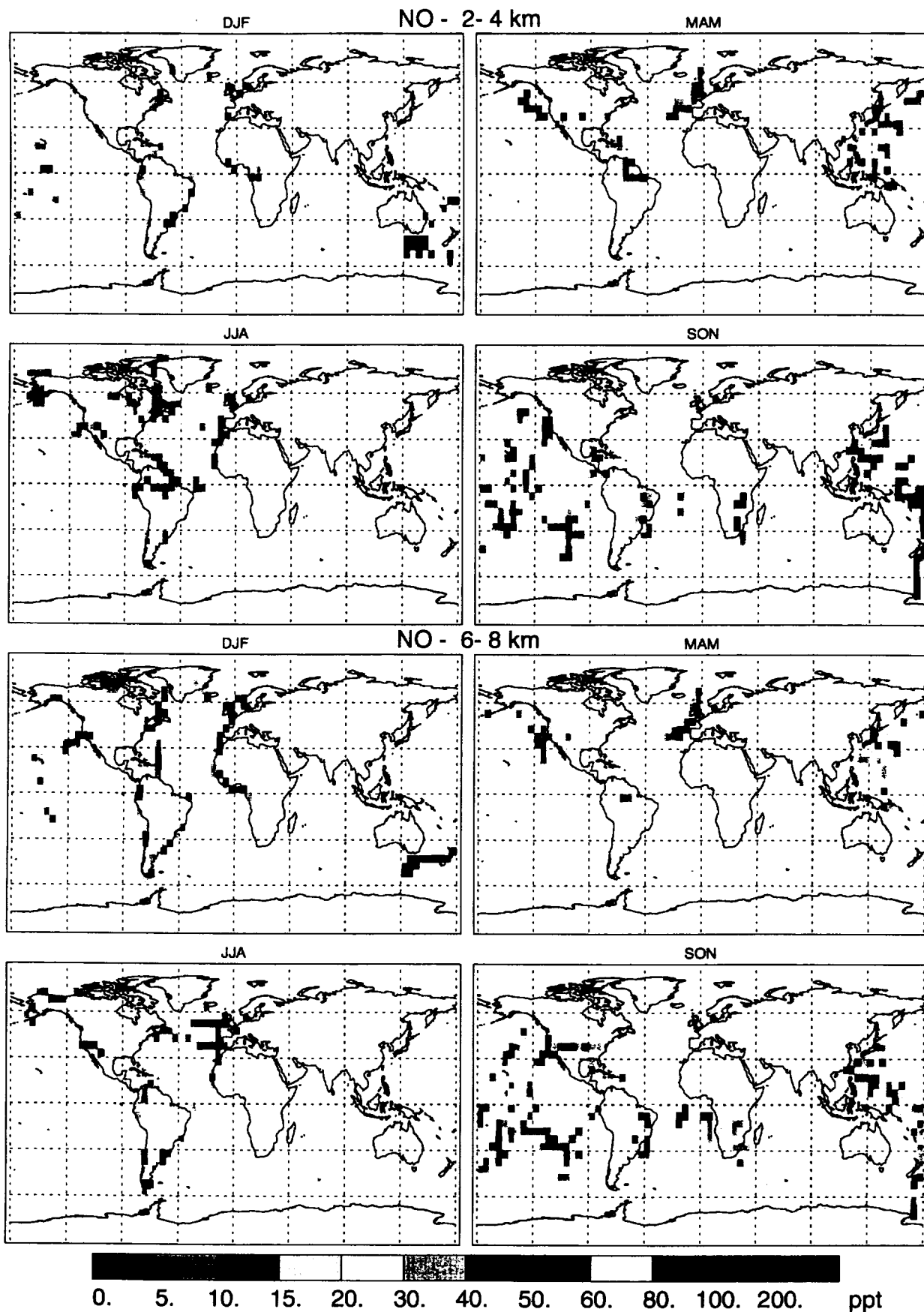
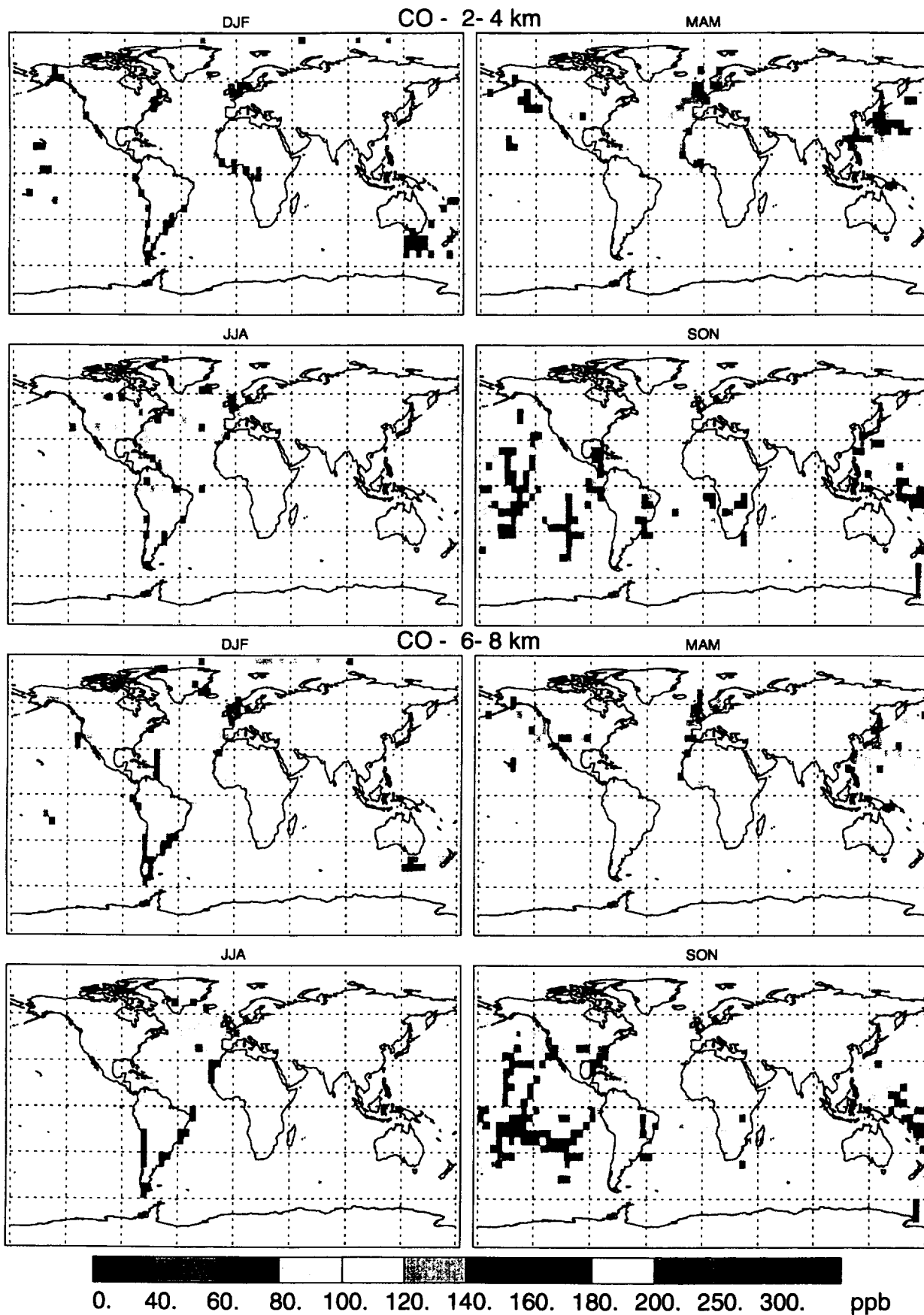
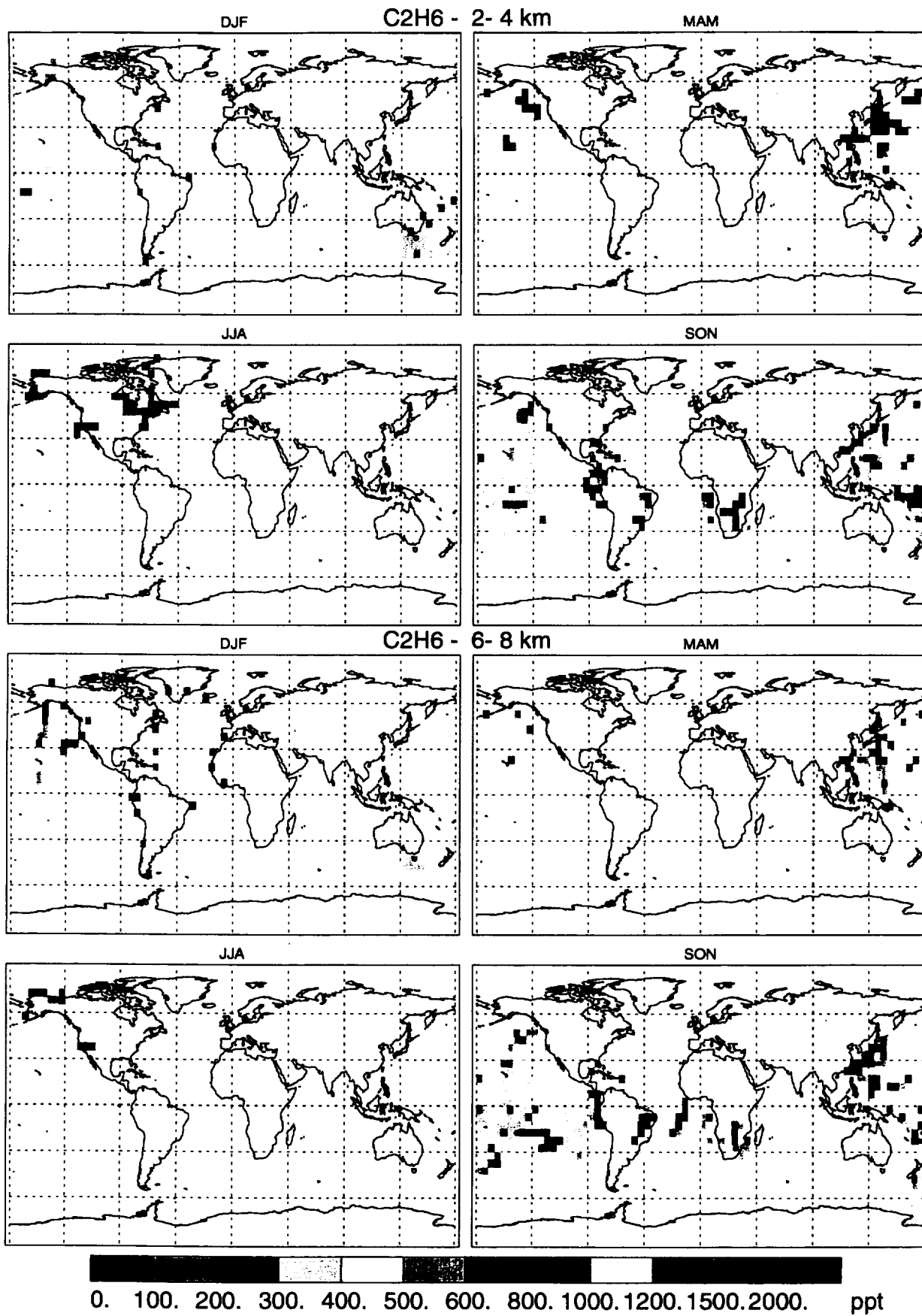


Fig. 12



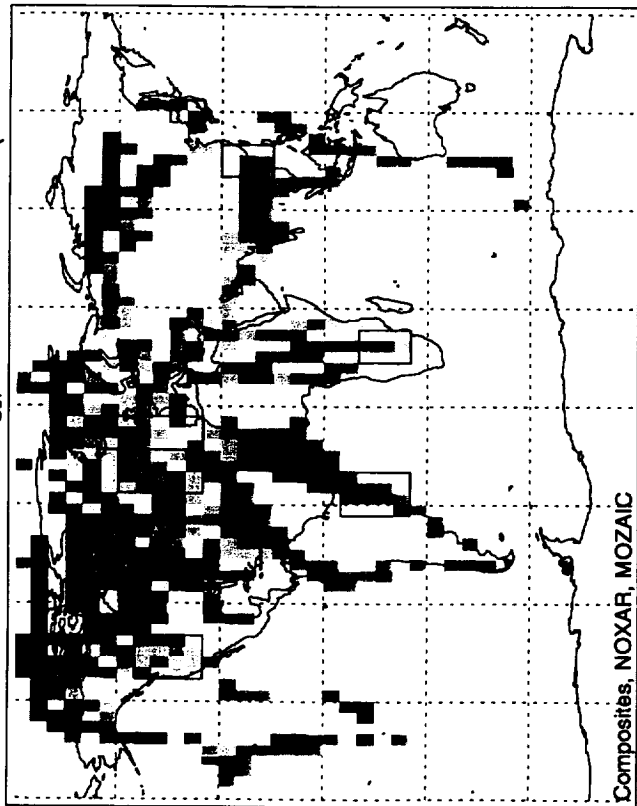




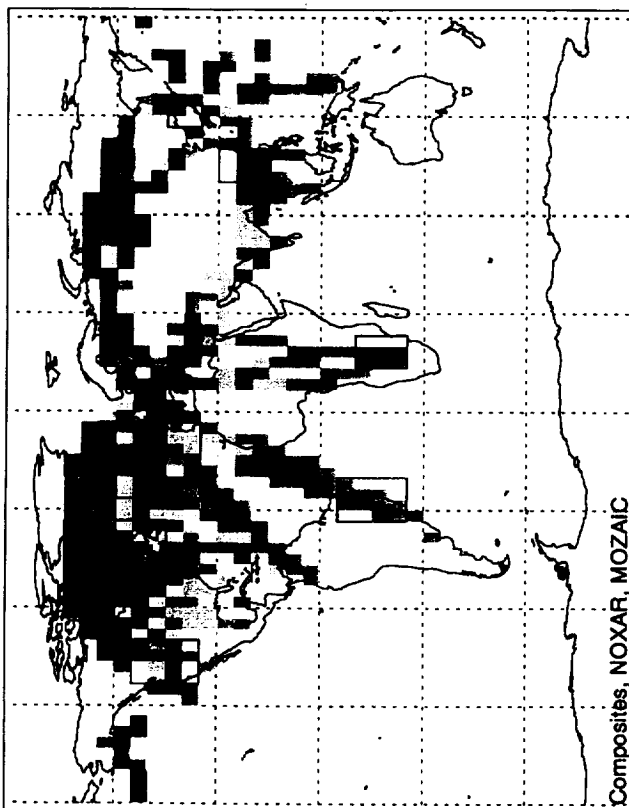


O3 (DIAL+in situ) - 10-11 km

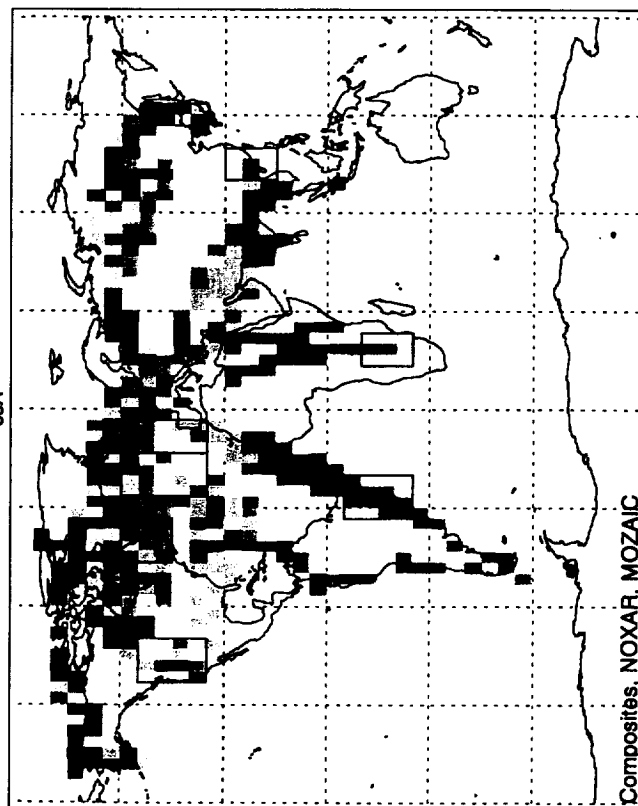
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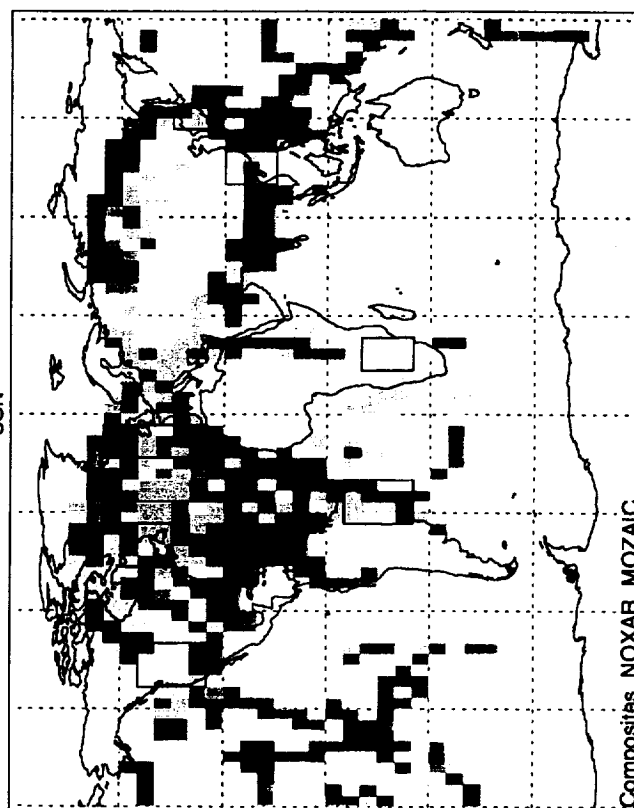
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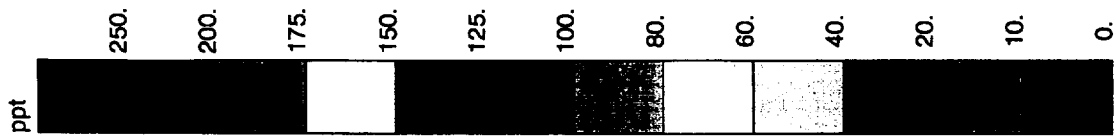


SON



ppb





NO - 10-11 km

